RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

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RADIOLOGY

A MONTHLY PUBLICATION DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

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Henry Ford Hospital, Detroit 2, Mich.

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RADIOLOGY

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PUBLISHED BY THE RADIOLOGICAL SOCIETY OF NORTH AMERICA

Vol. 59 OCTOBER 1952 No. 4

The Interpretation of Some Radiologic Signs of Abnormal Pulmonary Function[1]

ROBERT P. BARDEN, M.D.

Philadelphia, Penna.

MEDICAL PROGRESS in recent years has emphasized the physiologic disturbances that underlie the diseases of man. In many degenerative diseases and in most neoplastic conditions, alterations in bodily functions may precede, by months or years, any demonstrable anatomical change. In order to obtain the maximum information from radiologic examination of the chest, one must be constantly alert to the abnormalities in pulmonary function which may be present even with minimal anatomical changes. This paper will consider a few examples of what should be regarded as a fundamental principle in roentgen diagnosis.

The function of the lungs is to provide a continuous supply of oxygen to the blood circulating in the pulmonary capillaries and to remove excess carbon dioxide from the blood stream. Detailed descriptions of the factors involved in pulmonary function can be found in papers by Baldwin, *et al.* (1) and by Comroe (4). The application of radiologic methods in the detection of abnormal pulmonary function will be discussed in subsequent communications (2). Suffice it to say here that careful and complete fluoroscopic examination of the chest and roentgenograms in full inspiration and full expiration, in various positions, and with and without the use of the Potter-Bucky diaphragm, are fundamental requirements. Additional roentgen information concerning abnormal pulmonary function can be obtained during bronchography with radiopaque material, by the application of various degrees of positive and negative pressures to the thoracic cavity, and during the procedure of angiocardiography.

Normal ventilation of the lungs presupposes not only an adequate amount of inspired air but also its symmetrical distribution. Emphysema is a condition in which the inspired air is distributed in an irregular, non-symmetrical manner and may be manifest on roentgenograms of the chest by localized or diffuse areas of overinflated lung. These areas do not deflate at full expiration in as complete a fashion as one would expect normal lung tissue to do. Because of this irregular expansion of lung tissue, the pattern of pulmonary markings is disturbed in the involved area. Fluoroscopic examination may disclose abnormal mobility of a group of vascular shadows due to faulty ventilation of adjacent lung (5), and roentgenograms will show interlacing, circinate markings instead of the normal regular fan-like arrangement. This latter finding is often

[1] From the Department of Radiology, Chestnut Hill Hospital, Philadelphia, Penna. Presented at the Thirty-seventh Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 2–7, 1951.

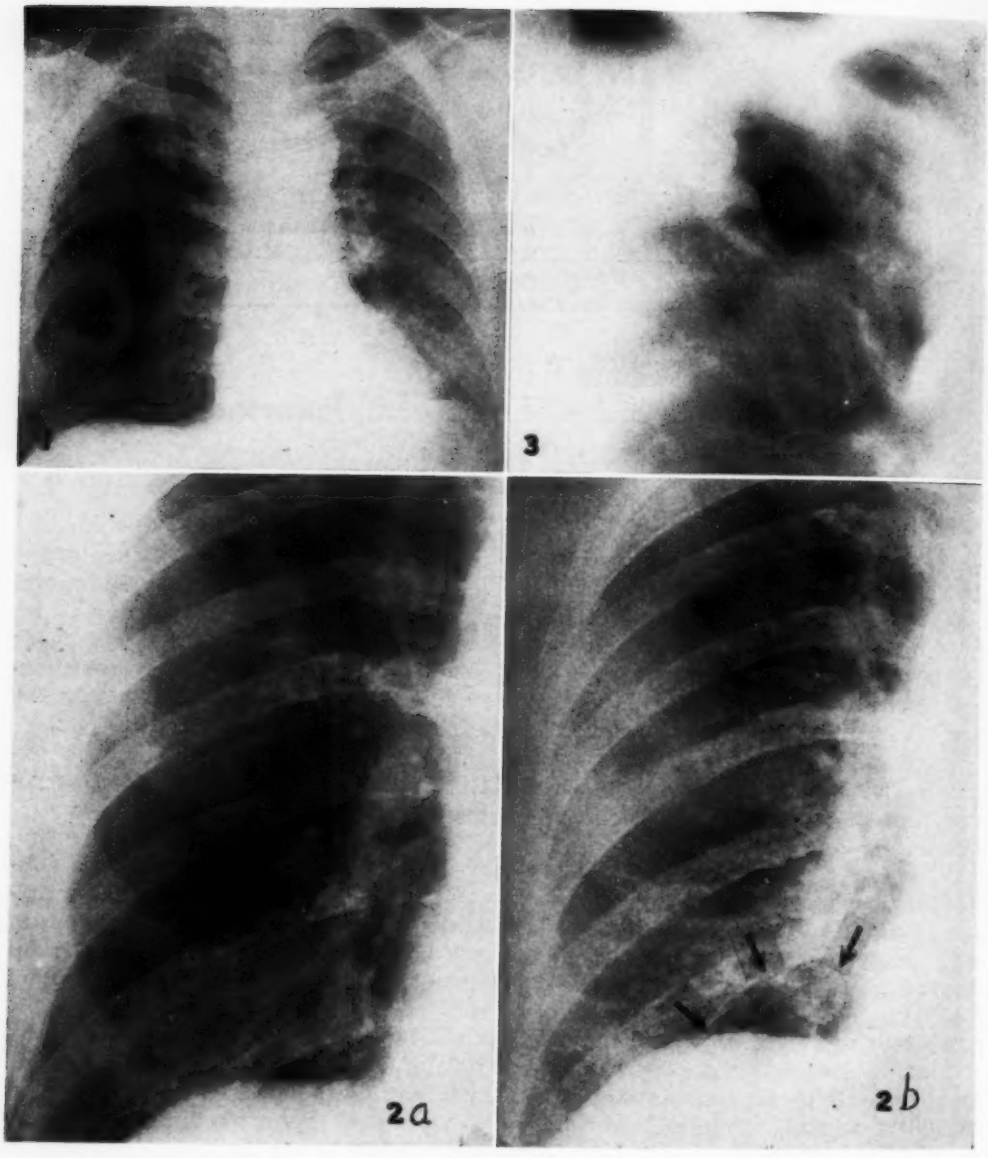


Fig. 1. Roentgenogram of the chest of a 59-year-old male complaining of cough, blood-tinged sputum, and increasing dyspnea. This exposure was made during full expiration. Note the over-distention of the entire right lung as a result of partial obstruction of the right main stem bronchus due to carcinoma. This illustrates the physiologic abnormality that occurs with partial obstruction in a large bronchus.

Fig. 2. a. Roentgenogram of the right lower lung field of a middle-aged white male complaining of chronic cough and dyspnea. This exposure was obtained during full inspiration and shows nothing abnormal.

b. Roentgenogram of the right lower lung field of the same patient during full expiration. Note the localized area of over-distention in the portion of the lung lying just above the cardiophrenic angle. This segment of the lung did not deflate, as did the surrounding normal lung, during expiration and therefore is revealed as an island of trapped air in the roentgenogram made during expiration. This illustrates the result of partial obstruction of a segmental bronchus due to a non-malignant stricture.

Fig. 3. Body section roentgenogram of the right upper lung field of a young physician known to have had tuberculosis. Note the "tennis-racket" shape of the shadows extending out from the right hilus. This represents a small bronchus with thickening of the walls due to inflammatory disease and partial obstruction of the lumen, which has led to over-distention of a pulmonary lobule or group of lobules served by this bronchus. This appearance should not be misinterpreted as a cavity due to caseating disease. The findings show the result of partial obstruction in a bronchus of minor order with over-distention of a pulmonary area of smaller size than a segment.

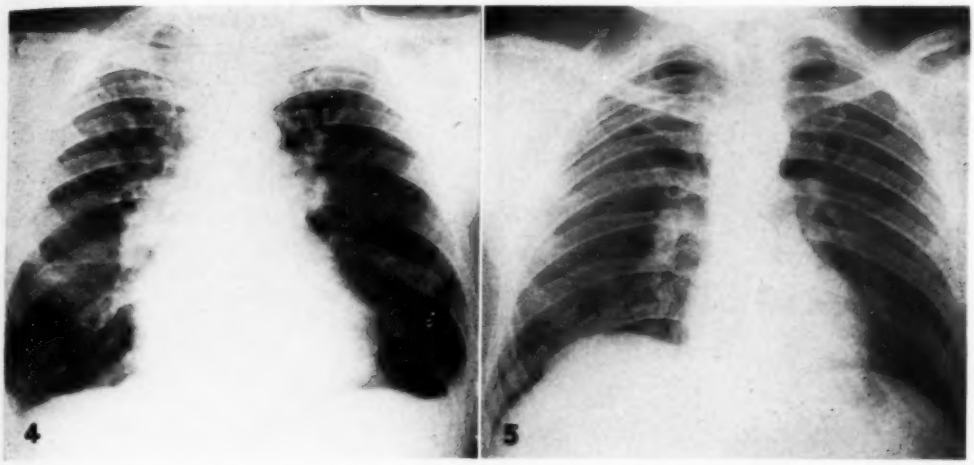


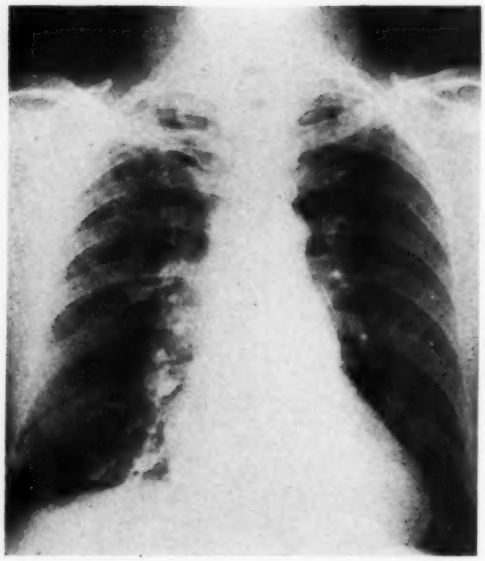
Fig. 4. Roentgenogram of the chest of a middle-aged patient with severe dyspnea, cough, and cyanosis. Fluoroscopic study had shown depression and fixation of each half of the diaphragm during respiration, which were confirmed by films made in the extremes of the respiratory cycle. This illustration shows thickening of the basal pleura, which contributes to the fixation of the chest wall, and over-distention of the lower half of each lung. In addition, there is enlargement of the main pulmonary arteries indicating increased vascular tension. These findings indicate chronic pulmonary insufficiency which occurs with advanced degrees of diffuse emphysema. In this patient the fundamental abnormality exists in the pulmonary parenchyma rather than in the bronchial tree. In spite of the large amount of air in the lungs, ventilation is inadequate because most of the air is immobilized.

Fig. 5. Roentgenogram of the chest of a 30-year-old white male complaining of repeated attacks of bronchitis for many years. Physical examination showed nothing abnormal, and on fluoroscopic study the diaphragm was seen to move well on each side. The roentgenogram, however, shows irregular distribution of the smaller lung markings on both sides, indicating that ventilation of the lungs is not symmetrical, due to numerous small areas of emphysema. This interpretation was confirmed by pulmonary function tests which showed irregular diffusion of inspired oxygen. Such findings in a patient of this age carry the same prognostic significance as the scarring found in chronic interstitial nephritis, for example. Even though the lungs are compensating well for the abnormal anatomical changes at present, it may be expected that pulmonary insufficiency will occur as the patient becomes older.

most prominent in films made in the lateral projection. The physiological disturbances in the lung and in the body economy produced by emphysema, and the details of microscopic pathology accompanying it, are beyond the scope of this paper.

One must realize, however, that emphysema often leads to chronic pulmonary insufficiency and may produce disability as severe as that of myocardial or renal failure. For practical purposes, it is important to recognize two types of emphysema which may be seen on roentgen examination. One is obstructive emphysema, which may occur as a result of foreign material or stricture in any part of the bronchial tree from the trachea to a lobular bronchus (Figs. 1, 2, and 3). The other is the emphysema which occurs as a result of degenerative changes and loss of elasticity in the walls of alveoli and lobules due to disease or failure of these pulmonary end organs (Figs. 4 and 5). One might consider that the first type is due to extrinsic factors (considering the bronchial tree as outside the lung) and the second type to intrinsic factors.

Normal oxygenation of the blood presupposes an adequate blood supply to the lungs, as well as sufficient and equal ventilation. Diseases affecting the peripheral pulmonary blood vessels may obstruct or obliterate them and markedly reduce the number of channels available for the circulating blood. Arteriolar sclerosis is a common degenerative condition in the lung as well as in the rest of the body. The roentgen signs of pulmonary hypertension and arteriolar sclerosis have been fully described in the past (3, 6, 8). The essential findings in this condition are enlargement of the main pulmonary arteries and disappearance of the finer lung markings.



In the normal chest these markings are due to small peripheral arteries, which become obliterated in arteriolar sclerosis and therefore cast no shadows (Fig. 6).

Localized obliteration of large pulmonary vessels is now recognized as a common complication in the postoperative patient and in many patients suffering from cir-

Fig. 6. Roentgenogram of the chest of a middle-aged white male complaining of dyspnea and cyanosis. Note the moderate cardiac enlargement and the marked enlargement of the main pulmonary arteries. In spite of this, the shadows of the peripheral pulmonary vessels in the outer third of each lung are quite inconspicuous. These findings are quite different from those seen in chronic passive congestion or any condition where there is an increased amount of blood in the lungs. They indicate that there is hypertension in the pulmonary arteries and obliteration of many vessels in the peripheral vascular bed. The reduction in pulmonary circulation which ensues interferes with adequate oxygenation of the blood and is responsible for the symptoms and signs. Autopsy in this case disclosed extensive arteriolar sclerosis throughout both lungs.

Fig. 7. Roentgenogram of the chest of a 45-year-old colored male complaining of dyspnea of several weeks duration. Fluoroscopic examination of the chest had shown no functional abnormality. Tests of pulmonary ventilation showed nothing abnormal. The roentgenogram reveals striking absence of the normal vascular shadows in the middle and outer thirds of each lung. The main pulmonary arteries appear somewhat smaller than usual. Postmortem examination of this patient showed a large thrombus in each pulmonary artery associated with extensive areas of infarction in each lung. The patient's dyspnea was thought to be due to reflex stimulation of the central nervous system, which often accompanies sudden obstruction in pulmonary arteries. It should have been possible to arrive at a correct diagnosis in this case by correlating the roentgen changes with the symptoms and the negative findings in the pulmonary function tests.

Fig. 8. Roentgenogram of the chest of a middle-aged white male complaining of severe dyspnea. In addition to the large cavity seen in the left upper lobe, there are areas in the right middle and right lower lung field and at the base of the left lung where the normal vascular markings are not seen. Although one might interpret these changes as due to localized areas of emphysema, one does not see as much distortion of the lung markings adjacent to these areas as might be expected in emphysema. Postmortem examination showed many large and small infarcts throughout both lungs, with a large necrotic area in the left upper lobe. Obstruction of large and small pulmonary arteries had occurred as a result of a lymphosarcoma permeating directly through the vascular bed and producing mechanical obstruction. The roentgen findings illustrate the appearance of so-called "bloodless infarcts" and the difficulty encountered in differentiating them from areas of localized emphysema.

Fig. 9. a. Roentgenogram of the chest of a middle-aged white male complaining of repeated hemoptysis and polycythemia. Note the irregular nodular shadows in the right lower lobe. The shape and distribution of these shadows should suggest the possibility of multiple hemangiomas or arteriovenous fistulae. These shadows often become smaller when positive pressure is applied to the lungs, as a result of the Valvsalva maneuver, for example. The diagnosis may be further supported by determining the ability of the peripheral blood to take up oxygen. In the presence of an arteriovenous shunt in the lung, the peripheral blood will never become completely saturated even though pure oxygen is breathed.

b. Roentgenogram following intravenous injection of radiopaque material into one of the antecubital veins of the arm, showing the distribution of the opaque material in the pulmonary blood vessels. Note that, in addition to the opacification of the nodular shadows in the right lower lobe, one sees similar and unsuspected fistulae in the left lower lobe. Although surgical removal of localized hemangiomas or arteriovenous fistulae in the lungs may be a life-saving procedure, it is evident that a complete anatomical study of the pulmonary system by opacification methods is necessary before definitive surgery is undertaken.

culatory failure. While the presence of consolidation due to hemorrhage following pulmonary infarct was well known for many years, it remained for Westermark (9), and later Shapiro and Rigler (7), to describe the roentgen changes in so-called "anemic" pulmonary infarcts. When the circulation to a segment of lung is suddenly obstructed, hemorrhage into the area may be delayed or may not occur at all, as a result of collateral circulation. In this event, one sees an area devoid of lung markings, surrounded by a normal vasculature (Figs. 7 and 8). The roentgen findings may resemble those found in localized emphysema. The correct interpretation depends upon knowledge of the clinical history and absence of the distorted lung markings which surround an area of irregular ventilation or hyperventilation.

When arterial blood circulates through a portion of the lung without receiving oxygen, a shunt is established and 100 per cent oxygenation of the systemic arterial blood cannot occur even when pure oxygen is breathed. This condition occurs when relatively large segments of the lung are collapsed, in which case characteristic anatomical changes appear on the chest roentgenogram. A similar situation exists, however, when a pulmonary arteriovenous fistula is present, and in these circumstances routine films may show little or no anatomical abnormality. The finding of one or more irregular nodular shadows in the pulmonary fields should arouse suspicion of an arteriovenous fistula, especially if hemoptysis or compensatory polycythemia is present. If these shadows are large enough, one may be able to demonstrate reduction in size by maneuvers which

increase intrathoracic pressure (Valsalva). The final diagnosis depends upon the demonstration of the fistula by angiocardiography. Surgical removal of these lesions is necessary to prevent death from pulmonary hemorrhage, heart failure, or the effects of secondary polycythemia. Unfortunately these fistulae are often multiple, and angiocardiography is important not only in making the diagnosis but also in demonstrating the size and extent of the lesions, some of which may be invisible on routine roentgenography (Fig. 9).

These illustrations should indicate the importance of interpreting minor anatomical changes seen on roentgenograms of the chest in terms of the profound physiological disturbances that may accompany them. Armed with this point of view, the radiologist will add greatly to the value of the roentgen examination as a diagnostic tool. Of even more importance, this success will encourage the search for additional radiological methods of studying pulmonary disease, and radiology as a science will be extended to new fields of physiological research.

NOTE: I wish to express my appreciation to Dr. E. P. Pendergrass, Director of the Department of Radiology, Hospital of the University of Pennsylvania, for lending me the roentgenograms from which the illustrations for this paper were made.

8835 Germantown Ave.
Philadelphia 18, Penna.

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SUMARIO

La Interpretación de Algunos Signos Radiológicos de Función Pulmonar Anormal

A fin de obtener la información máxima del examen radiológico del tórax, hay que estar constantemente a la mira de anomalías de la función pulmonar que pueden existir aun en presencia de mínimas alteraciones anatómicas. Recálcase la importancia de esas pequeñas alteraciones observadas roentgenológicamente, haciendo hincapié en la afectada ventilación pulmonar asociada con el enfisema generalizado y localizado y en los trastornos circulatorios comprendiendo infartos no hemorrágicos, esclerosis arteriolar obliterante y desviaciones arteriovenosas.

DISCUSSION

Eugene P. Pendergrass, M.D. (Philadelphia, Penna.): After listening to the presentation of Dr. Barden, one is convinced that he is an ardent exponent of doing the roentgen examination of the chest in a comprehensive manner and then evaluating observations made from that examination in relation to the clinical history and findings and what is known about pulmonary function. I heartily concur in that philosophy. There are many points that I would like to re-emphasize and comment upon, but that seems unnecessary at this time.

It has been my conviction that fluoroscopy should be done with the patient erect, if it is at all possible. In addition to the respiratory exercises suggested by Dr. Barden, I would like to mention the following as useful procedures: coughing, grunting, and sniffing, as well as fluoroscopy and roentgenography in the decubitus positions.

The value of sniffing was brought forcibly to my attention a few years ago by a clinician friend, Dr. D. A. Cooper, who referred to me a patient in whom he had made a diagnosis of an obstructive bronchial lesion. When conventional fluoroscopy and conventional roentgenograms made in the inspiratory and expiratory phases failed to demonstrate the lesion, I called Dr. Cooper and he told me that, if I had the patient sniff during fluoroscopic observation, I could demonstrate the mediastinal displacement and the obstructive aeration in the affected segment of the lung. This I did, and since that time I have been having patients sniff in all fluoroscopic examinations. Not infrequently, it is thus possible to discover obstructive emphysema that cannot be demonstrated by forced respiration.

Further discussion of Dr. Barden's paper will be limited to his comments concerning the "roentgen changes in so-called 'anemic' pulmonary infarcts." As he stated, Westermark in 1938 and again in 1948 (Roentgen Studies of the Lungs and Heart, University of Minnesota Press), and Shapiro and Rigler in 1948, reported that "in those cases showing lung embolism without infarction the ischemia of the distributed area of the pulmonary artery on the peripheral side of the embolus or emboli has appeared on the radiogram as a local and well defined clarified zone with diminished or absent vascularization. In an area corresponding to the site of the embolus, and on the central side of this, the vascular design has been well maintained but seems to stop abruptly. On account of the distribution of the arterial branches, the clarified zone assumes the shape of a wedge with its apex directed toward the hilus and its base toward the periphery of the lung."

According to Rauber and Kopsch (Lehrbuch und Atlas der Anatomie des Menschen, Band II, 1941), there exists in man an extensive anastomosis between the two circulations, which is partly arteriolar and partly capillary in nature. According to Ellenberger and Baum (Handbuch der vergleichenden Anatomie der Haustiere, 1943) the anatomical conditions are analogous in domestic animals. These observations are supported by those of Kjellberg and Olsson. In a recent article on "Roentgenological Studies of Experimental Pulmonary Embolism Without Complicating Infarction in the Dog" (Acta radiol. **33:** 507–514, 1950), these latter authors report the experimental production of pulmonary embolism in dogs without roentgenologic changes within the lung fields in the presence of a normal circulation. Artificial emboli were introduced into the circulation and into the larger branches of the pulmonary artery, and roentgen examinations were obtained before and after the lodgment of the emboli. Of 8 animals in whom the obstructive character of the embolus was established postmortem, none showed any changes on the roentgenogram after the lodging of the embolus. In one case this phenomenon was observed at operation.

I have seen the roentgen findings described by Dr. Barden and on two occasions we have had a postmortem examination which seemed to confirm the premortem diagnosis. It had been my belief that the observations of Westermark and of Shapiro and Rigler were quite definite, but after reading the rather careful experimental work of Kjellberg and Olsson, I believe it behooves us to re-evaluate all cases of supposed anemic infarcts. These latter authors state: "Our investigations support the current opinion that no roentgenologic changes in the lungs are observed in uncomplicated pulmonary embolism. Further, it can be stated that no infarction will occur as long as the circulation through the bronchial artery is undisturbed."

Until this question is decided, I believe that it is entirely proper to call attention to "the so-called anemic infarct" and at the same time tell our clinical colleagues that there may be some other explanation for the roentgen observation. It also behooves us to study those portions of the lung very carefully in patients who come before us, in an attempt to solve the present difference of opinion.

Ross Golden, M.D. (New York, N. Y.): A question for Dr. Barden: Many years ago Lindskog and Van Allen (Aerodynamics of Bronchial Obstruction. Arch. Surg. **24:** 204–230, 1932) showed on normal dogs that if an obstruction was placed distal to the first branch bronchus in

the main bronchus to a lobe, neither obstructive emphysema nor atelectasis would occur. This they attributed to "collateral respiration," the passing of air from one lobule to another, presumably through interalveolar connections. To produce atelectasis, the lobar bronchus had to be occluded proximal to the first branch bronchus. In the human, segmental atelectasis apparently can occur. I would like to ask Dr. Barden whether he has found evidence of this collateral respiration in the human lung.

Leo G. Rigler, M.D. (Minneapolis, Minn.): I was most interested in Dr. Barden's presentation, and I think it is a very important one, particularly his remarks about vascular distribution. I would comment on it, since we have been studying this rather intensely for some time.

First, with regard to the matter of embolism without infarction: I am sure Dr. Barden is familiar with the work of Kjellberg, who apparently, on animals at least, showed that there was no area of increased anemia in the embolized segment of lung. It can be seen from Dr. Barden's films, and those we published, that there certainly appears to be an area of increased radiability in the segment of lung supplied by the thrombosed vessel. I would like to ask Dr. Barden if he has observed any relation between the experimental work which he has done and that of Kjellberg and his associates.

Second, are the cases of pulmonary arteriolar sclerosis. If one follows such cases before cyanosis develops, or even any particular symptoms, it will be found that there is a distinct difference from the vascular design which Dr. Barden showed. As a matter of fact, the peripheral arteries are increased in size in that situation, as well as the major pulmonary arteries; but as time goes on and one follows the condition to its end stage, these peripheral vessels begin to become obliterated; this does not apply to the major pulmonary arteries, which continue to enlarge. What I wish to bring to your attention is the fact that in the earlier stages of pulmonary arteriosclerosis the appearance may be quite different, so far as the peripheral vessels are concerned, than in the late stages which Dr. Barden exhibited.

In regard to pulmonary arteriovenous fistula, I would point out that we have studied a number of cases, using varying degrees of intra-alveolar pressure. It should be noted that almost all arteriovenous fistulas are constructed of two components There is a series of large vessels and there is a sac with which they communicate; the sac itself is filled with blood. If one studies such cases with changes in the intra-alveolar pressure, it is possible to see very striking changes in the vessels which go to the sac, but there may be very little change in the sac itself. We have found this a very valuable help in making the diagnosis. Roentgenograms made with low and high pressures serve well enough to make contrast arteriography unnecessary.

Dr. Barden (*closing*): First I would like to thank the discussants for adding so much to the value of my paper. In regard to Dr. Golden's question concerning communication between various portions of the lung, I am familiar with the concept of Cohnheim's pores and the argument which has taken place about whether or not they exist. It seems as if there may be good evidence for the existence of these minute openings between the alveolar walls both in dogs and in man. On the other hand, the experiments in dogs have been made with obstruction of a bronchus in an otherwise normal lung. The situation is somewhat different in patients with pulmonary disease, where the disease itself may have caused obliteration of these openings, thus interfering with the communication of air between the normal adjacent lung and the diseased area.

In regard to the comments of Dr. Pendergrass and Dr. Rigler concerning the discrepancy between the experimental findings of thrombosis of a pulmonary artery in the dog and the concept of a bloodless infarct in the human lung, I do not have any explanation for this discrepancy. I should think that it would be difficult to be sure about the similarity of the anatomical circulation in the dog and in the human being. There is one other explanation which might be considered, and that is the phenomenon of ischemia which may occur with a vascular insult and involve vessels which are not anatomically the site of any lesion. It is possible that in the living one may see the effects of such vasospasm on the roentgenogram even though at autopsy the circulation of the involved part may appear to be adequate by means of collateral vessels.

Detailed Roentgen Anatomy of the Orbits[1]

LEWIS E. ETTER, M.D.[2]
Pittsburgh, Penna.

A REVIEW OF THE anatomy of the orbits brings out many features of interest to the roentgenologist. Quite a few of the radiographic details with which we have to deal in a study of the skull are found in the orbits. These pyramidal cavities below the forehead are formed by frontal, sphenoid, zygomatic, maxillary, ethmoid, lacrimal, and palate bones. An attempt has been made to study them in detail and to demonstrate their various radiologic appearances (Fig. 1).

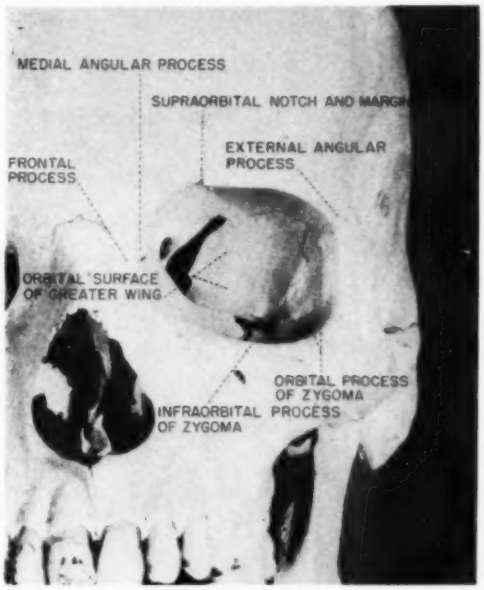


Figure 1

The postero-anterior view of the separate frontal bone shows what seems like two margins of the upper portion of the orbit (Fig. 2). The lower one is formed by the edge of the supraorbital margin and may be distinguished on many skull films by the supraorbital notch or foramen at the junction of the middle and inner third. A semicircular arching line above the supraorbital margin is formed by a cross section of the mid portion of the orbital plate and the little peaks of the juga cerebralia may be seen projecting upward from it (Fig. 3). The line extends laterally to form part of the medial edge of the lateral angular process and medially to merge with the medial angular process and the supraorbital margin at its junction with the ethmoid bone. Another gently curving line between the shadow of the mid portion of the orbital plate and the supraorbital margin is a sectional projection of the posterior margin of the orbital plate at its articulation with the greater and lesser wings of the sphenoid bone (Figs. 4 and 5). Extending obliquely downward and inward across the base of the external angular process of the frontal bone is a line of increased density representing a sectional projection of the temporal surface of the frontal bone which is continuous with the curving portion of the squamozygomatic surface of the greater wing of the sphenoid and represents the superior extension of the oblique orbital line, of which more will be said later (Figs. 6 and 7).

In the postero-anterior Waters' projection, an excellent view of the orbits is obtained (Figs. 8 and 9). There is very little change in the relations of the roentgenologic lines above described. A somewhat better view of the supraorbital margin is obtained in this projection and may be particularly useful in studying fractures of the superior orbital rim. Beside the medial extensions of the orbital plates at the medial angular processes, the medial walls of the orbits are formed by the lacrimal, ethmoid and palate bones. In some

[1] Read by title at the Thirty-seventh Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 2–7, 1951.

[2] Roentgenologist, Western Psychiatric Institute and Clinic, University of Pittsburgh Medical Center, Pittsburgh, Penna.

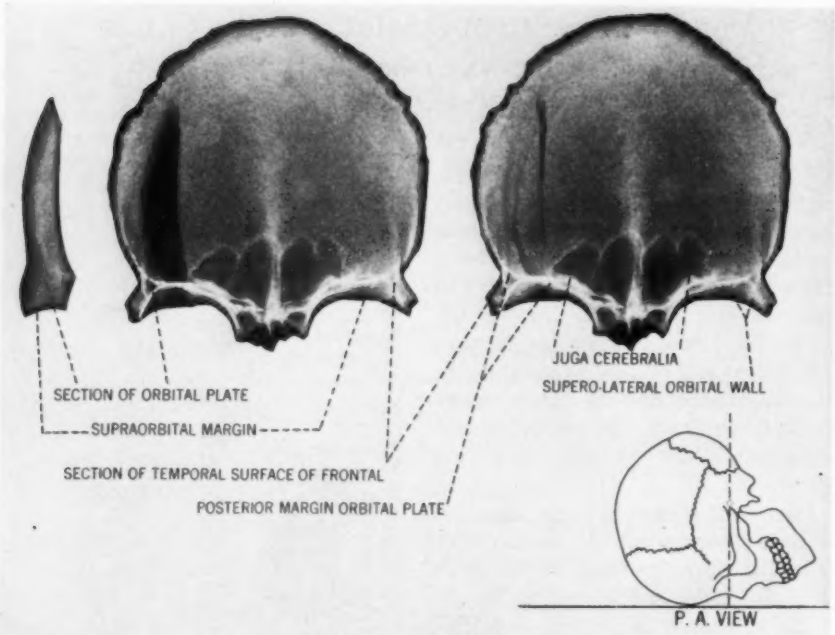


Figure 2

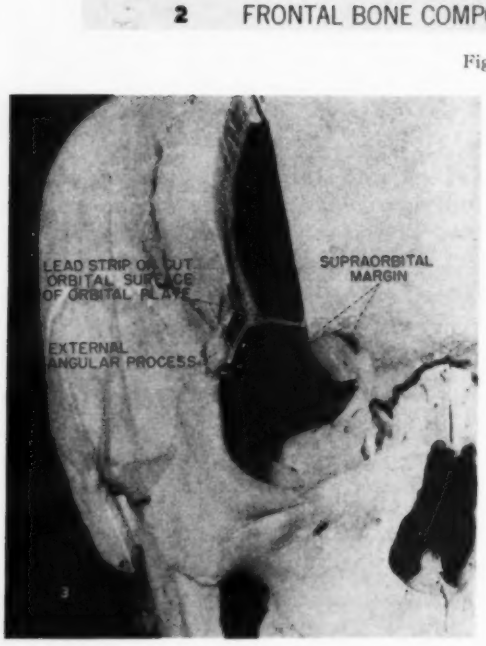
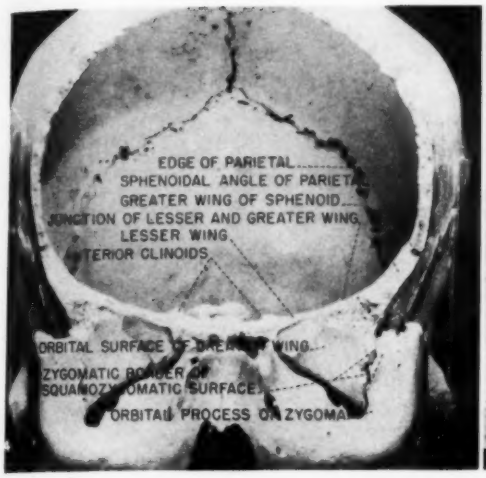


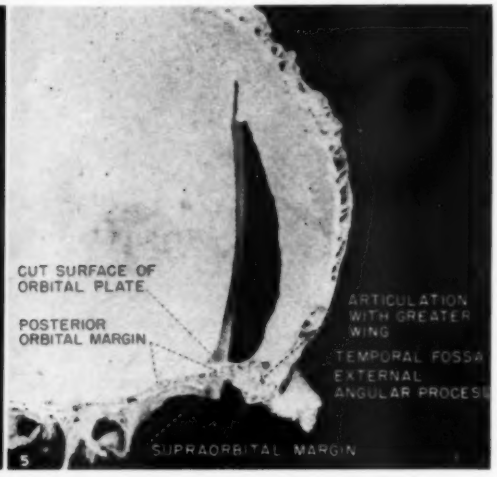
Figure 3

skulls extensions of the ethmoid and frontal sinus cells will be observed between the external and internal tables of the orbital plates. The frontal sinuses, showing great variations in size and shape, are readily distinguished above the medial halves of the orbits, although they may extend farther laterally, even into the external angular processes.

In the lateral view of the frontal bone components of the orbits (Fig. 10), there are shown principally the frontal sinuses, when this bone is pneumatized, with projections into them of two angular shadows formed by the supraorbital margins (Fig. 11).

The posterior components of these shadows are continuous with linear densities formed by sections of the under surfaces of the orbital plates, which then continue posteriorly to blend with the cross section of the lesser wing of the sphenoid bone (Fig. 12). The anterior components of these angles are shown as lines of increased density extending upward in the frontal sinuses and representing sectional projections of the curving surfaces of the external table of the frontal bone above each orbit.





Figures 4 and 5

Extending obliquely downward and backward from each of the angles formed as above described, the shadows of the external angular processes of the frontal bone are seen (Fig. 13) for articulation with the malar bones at the frontozygomatic suture.

Just above the horizontal lines formed by the under (orbital) surfaces of the orbital plates are seen two slightly wavy lines formed by the cerebral surfaces of the orbital plates. The little peak-like prominences are projected by the juga cerebralia anteriorly to merge with the inner table of the frontal bone posterior to the frontal sinuses. (Fig. 14). In many skulls there is extensive pneumatization between the cerebral and orbital surfaces of the orbital plates by extension between them of frontal sinus cells.

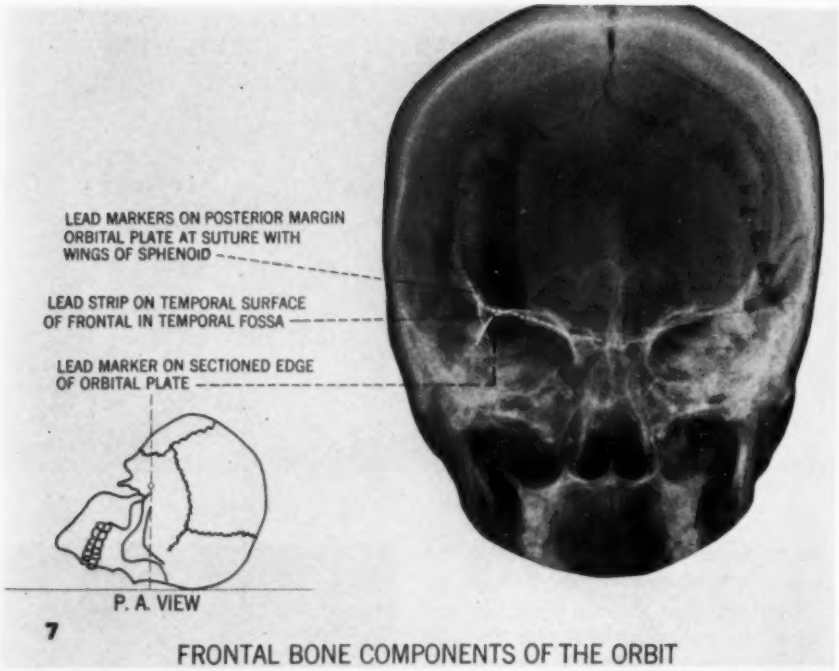
Two other fine horizontal lines are seen below those above described and represent the junctions of the medial edges or shelves of the orbital plates of the frontal with the cribriform plate of the ethmoid bone (Fig. 15).

The so-called linea innominata, or nameless line, *i.e.*, the oblique line slanting from above downward and inward in the lateral portion of the orbit, has been designated as such in a recent publication from Germany[3] This prominent line in postero-anterior

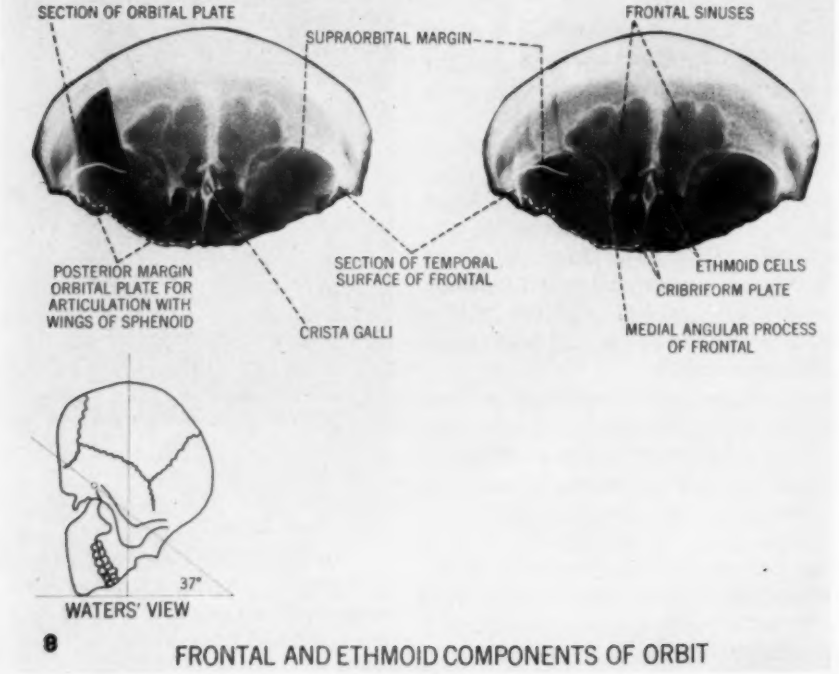
Figure 6

and oblique postero-anterior (Waters') views has been the subject of conjecture for many years, and for some time was thought to represent a section of the squamous temporal. But if one studies the sphenoid bone alone, it is readily seen

[3] Clementschitsch, F.: Die Röntgendarstellung des Gesichtsschädels. Wien, Urban & Schwarzenberg, 1948.


LEAD MARKERS ON POSTERIOR MARGIN ORBITAL PLATE AT SUTURE WITH WINGS OF SPHENOID
LEAD STRIP ON TEMPORAL SURFACE OF FRONTAL IN TEMPORAL FOSSA
LEAD MARKER ON SECTIONED EDGE OF ORBITAL PLATE
P. A. VIEW

7 FRONTAL BONE COMPONENTS OF THE ORBIT



8 FRONTAL AND ETHMOID COMPONENTS OF ORBIT

Figures 7 and 8

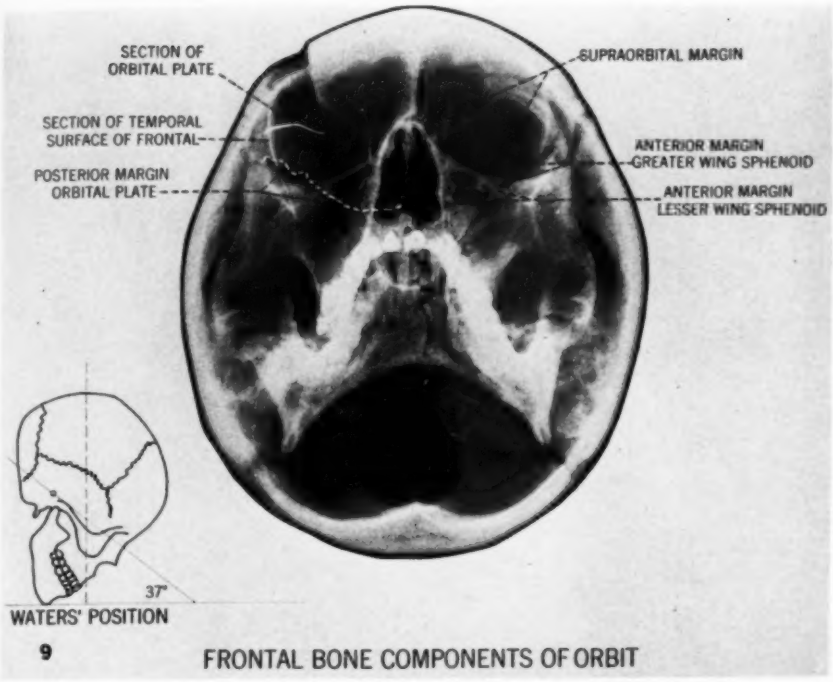
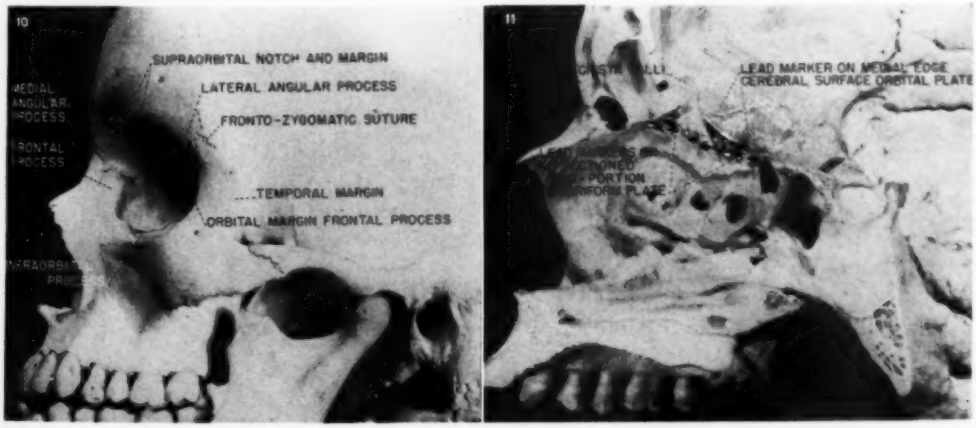
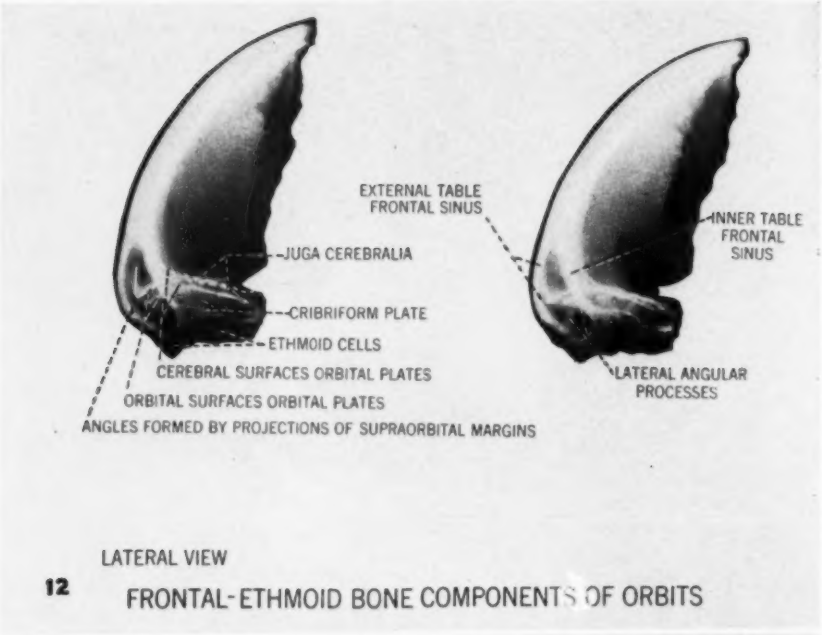


Figure 9

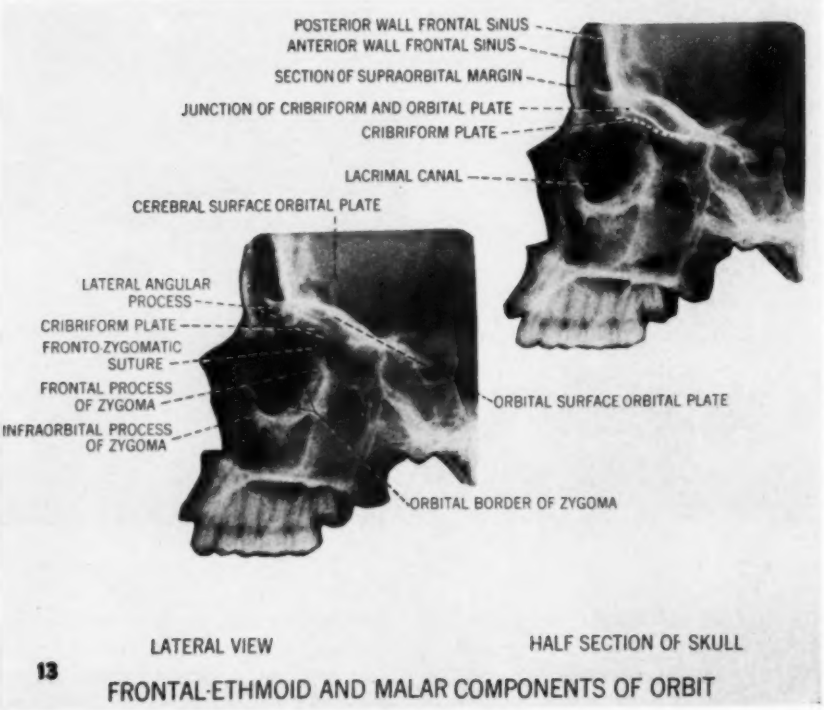


Figures 10 and 11

to be a part of this structure (Fig. 16). A little more detective work is required to determine its exact identity (Fig. 17). One-half a sphenoid bone was sectioned in the coronal plane exactly where the curving surface of the squamous and zygomatic portions of the squamozygomatic surface of the greater wing of the sphenoid intersect. Then a film of the larger portion showed only a faint trace of the line (Figs. 16, 17). When the two were rejoined, the line was distinctly shown, thus proving it

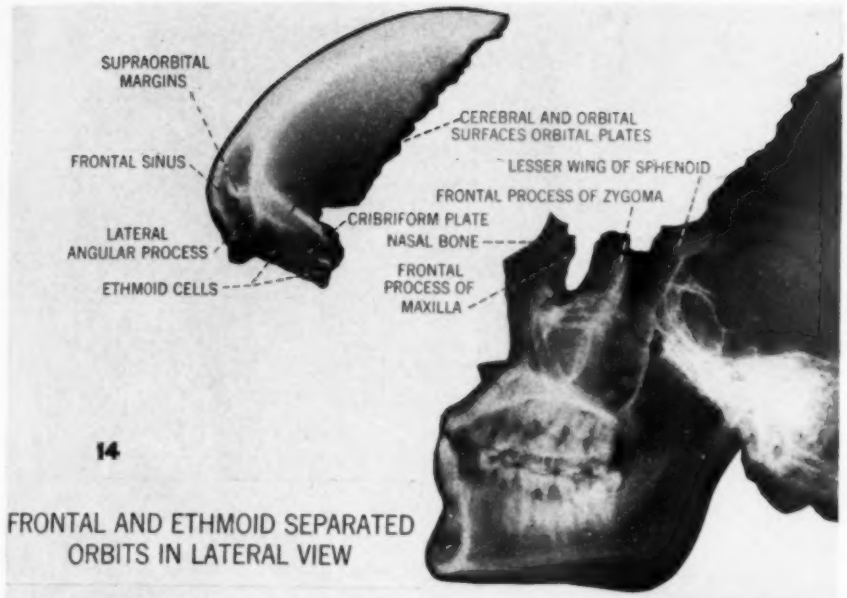


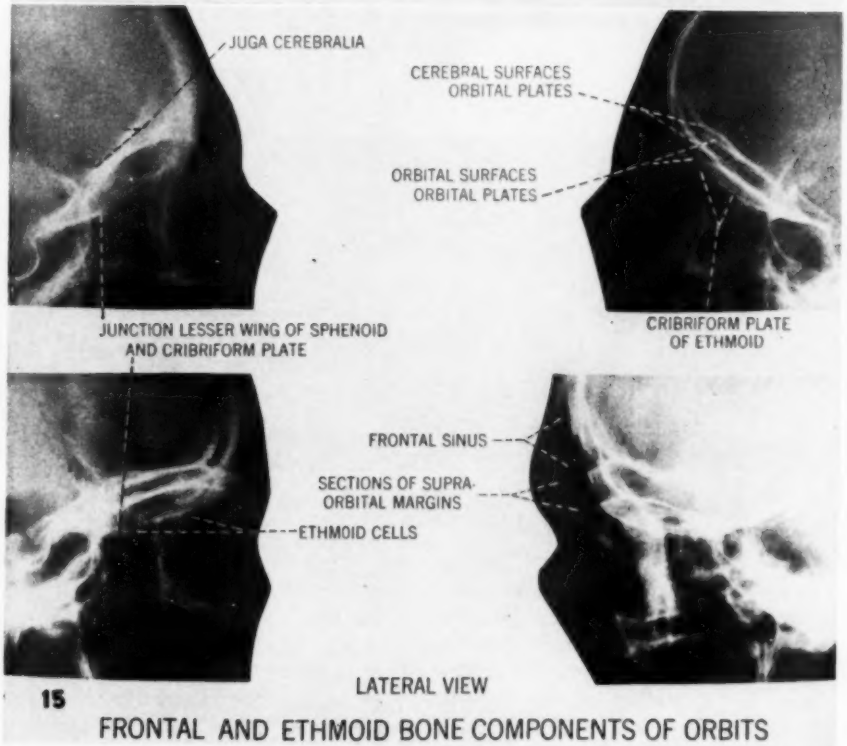
12 FRONTAL-ETHMOID BONE COMPONENTS OF ORBITS



13 FRONTAL-ETHMOID AND MALAR COMPONENTS OF ORBIT

Figures 12 and 13





Figures 14 and 15

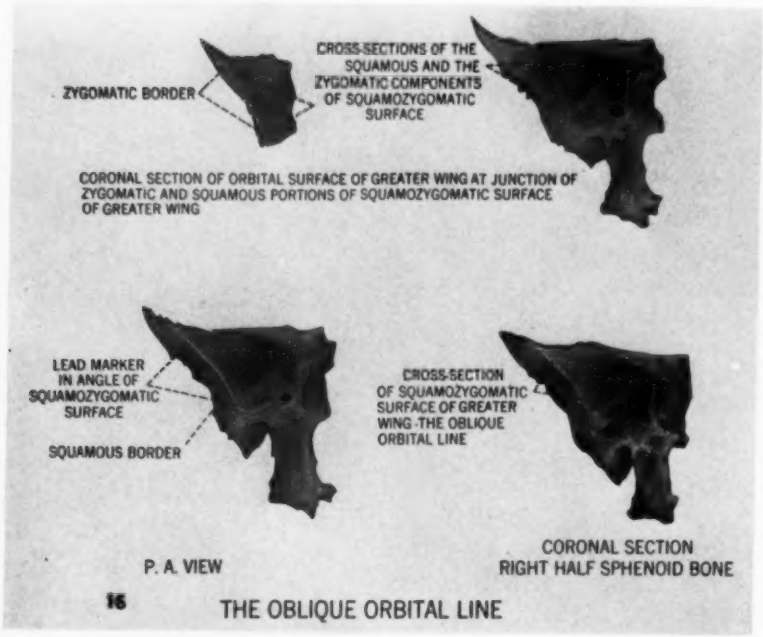
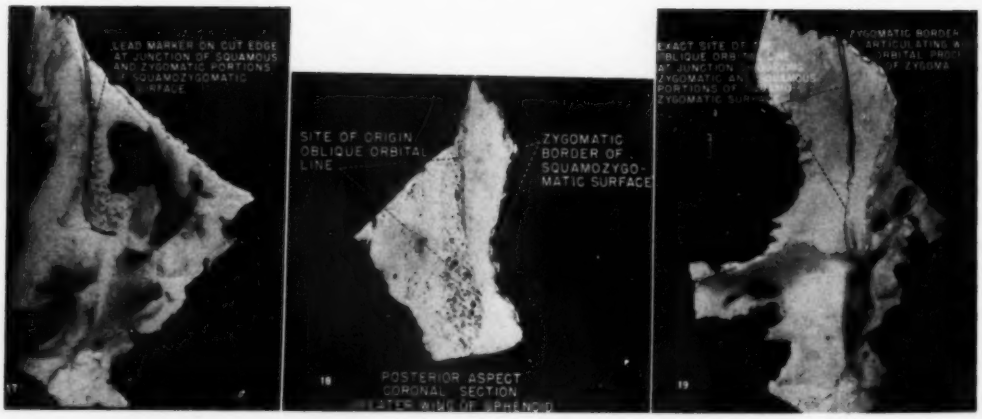

ZYGOMATIC BORDER
CROSS-SECTIONS OF THE SQUAMOUS AND THE ZYGOMATIC COMPONENTS OF SQUAMOZYGOMATIC SURFACE
CORONAL SECTION OF ORBITAL SURFACE OF GREATER WING AT JUNCTION OF ZYGOMATIC AND SQUAMOUS PORTIONS OF SQUAMOZYGOMATIC SURFACE OF GREATER WING
LEAD MARKER IN ANGLE OF SQUAMOZYGOMATIC SURFACE
SQUAMOUS BORDER
CROSS-SECTION OF SQUAMOZYGOMATIC SURFACE OF GREATER WING THE OBLIQUE ORBITAL LINE
P. A. VIEW
CORONAL SECTION RIGHT HALF SPHENOID BONE
16
THE OBLIQUE ORBITAL LINE

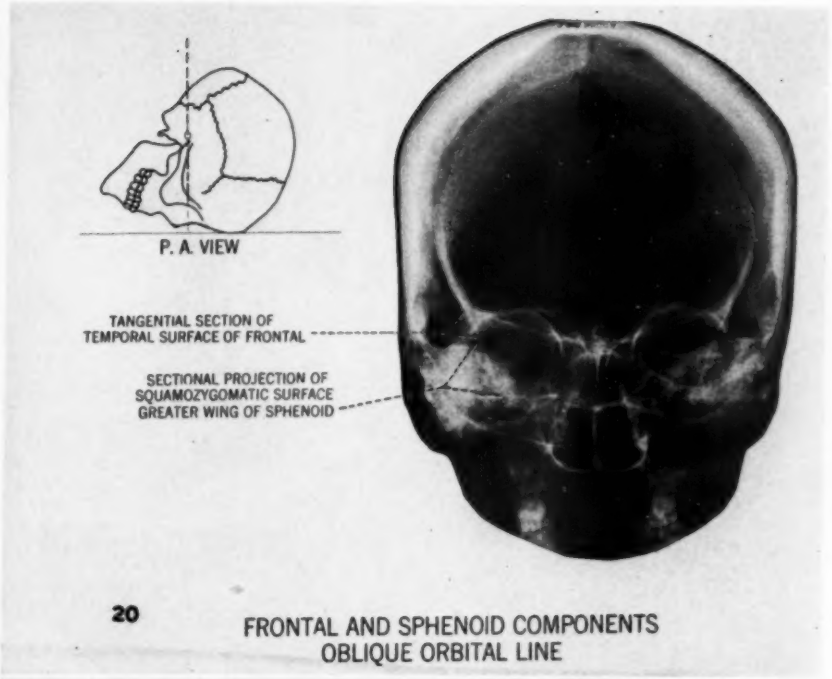
Figure 16


LEAD MARKER ON CUT EDGE AT JUNCTION OF SQUAMOUS AND ZYGOMATIC PORTIONS OF SQUAMOZYGOMATIC SURFACE
17
SITE OF ORIGIN OBLIQUE ORBITAL LINE
ZYGOMATIC BORDER OF SQUAMOZYGOMATIC SURFACE
18
POSTERIOR ASPECT CORONAL SECTION
ZYGOMATIC BORDER ARTICULATING
19

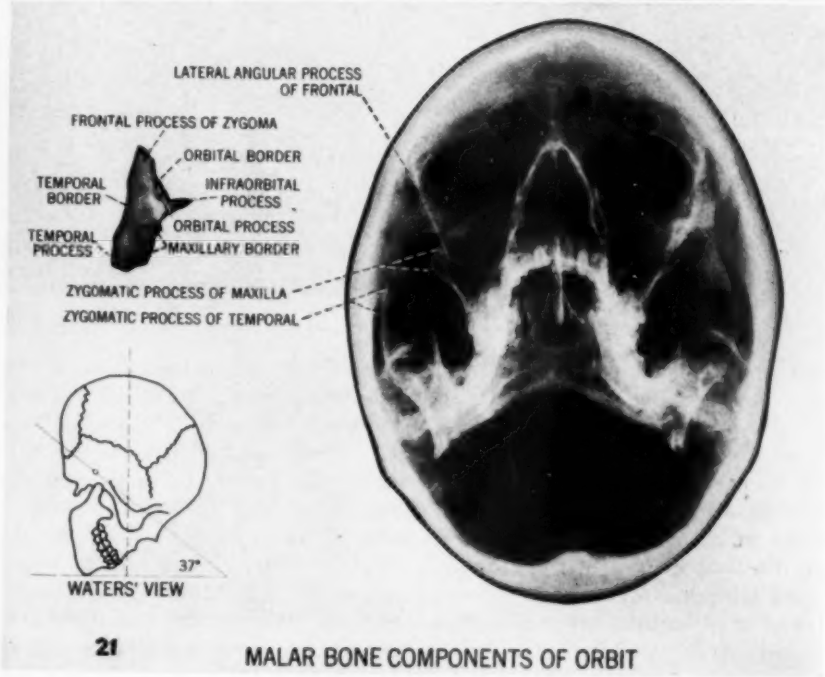
Figures 17, 18, and 19

to be formed by tangential projections of these two planes where they come together in the temporal fossa (Figs. 16, 19). As above described, a similar line is formed behind the external angular process of the frontal bone by a section of its curving temporal surface, and is continuous with the oblique orbital line of the sphenoid. This apparently continuous line is shown to have two components, both in the postero-anterior and Waters' projection (Fig. 20).

A very conspicuous part of the orbit in the oblique postero-anterior (Waters') view is that contributed by the zygoma or malar bone (Fig. 21). It forms a large part of the lateral and infero-lateral wall of the orbit. Its frontal process joins with

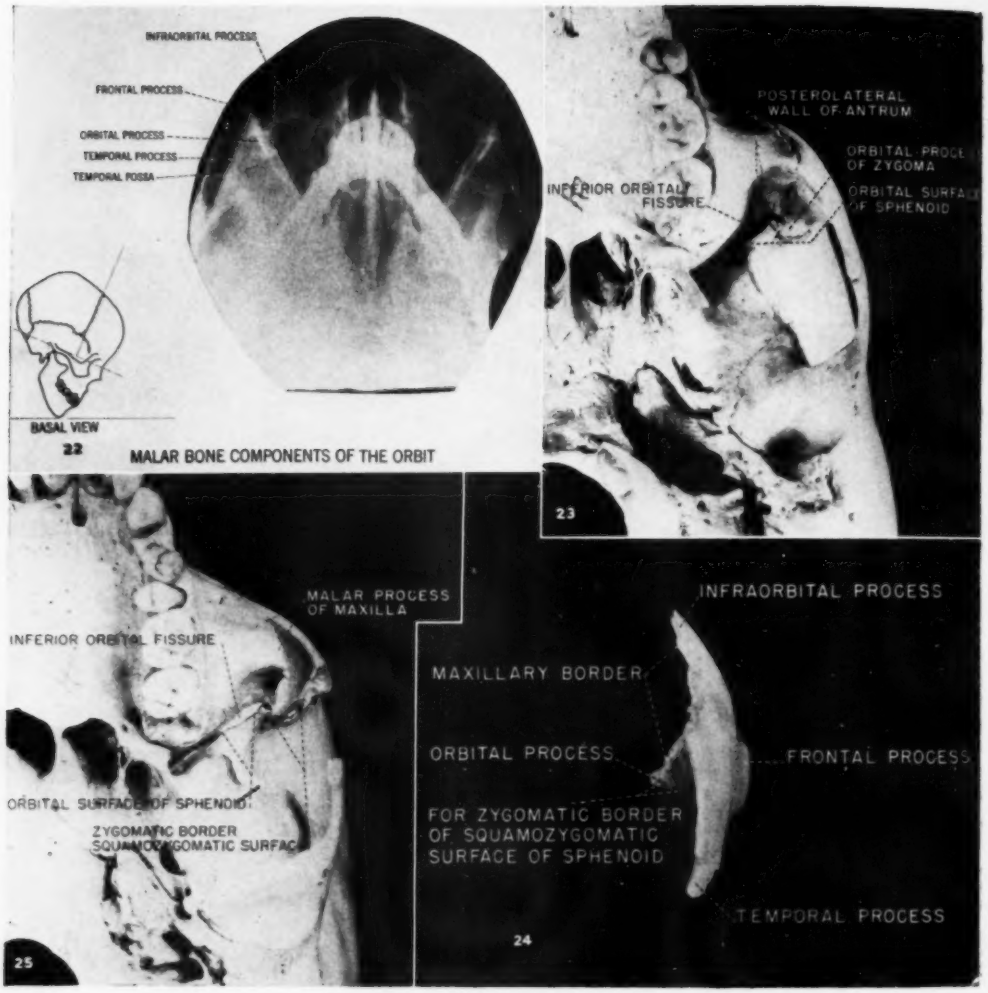

P. A. VIEW
TANGENTIAL SECTION OF TEMPORAL SURFACE OF FRONTAL
SECTIONAL PROJECTION OF SQUAMOZYGOMATIC SURFACE GREATER WING OF SPHENOID

20 FRONTAL AND SPHENOID COMPONENTS OBLIQUE ORBITAL LINE



21 MALAR BONE COMPONENTS OF ORBIT

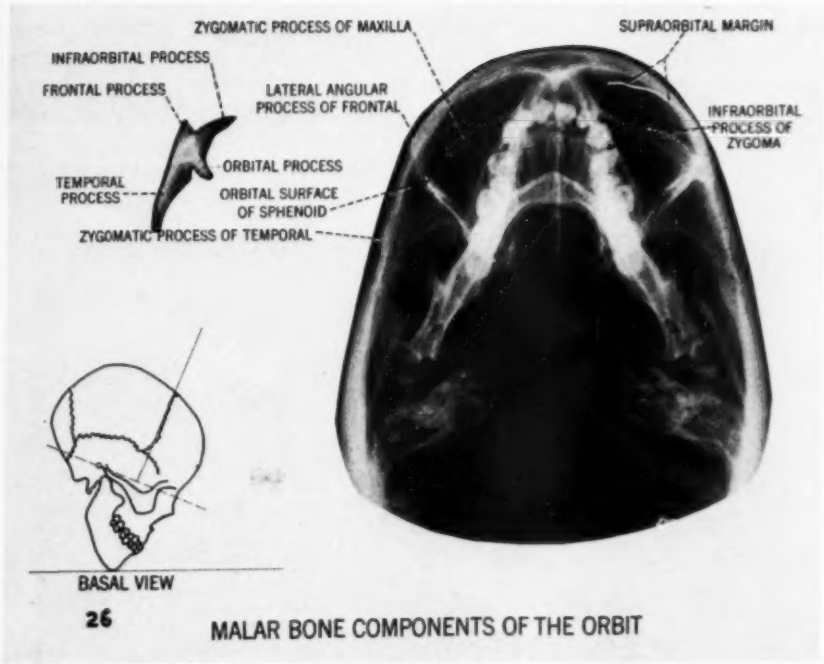
Figures 20 and 21



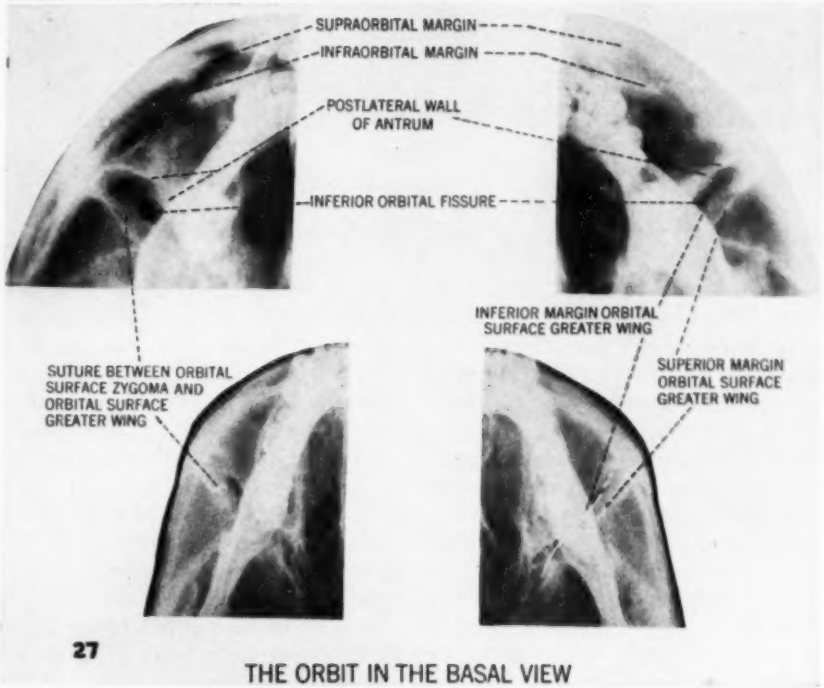
Figures 22, 23, 24, and 25

the external angular process of the frontal bone at the frontozygomatic suture, with the zygomatic process of the temporal by its temporal process to form the zygomatic arch over the temporal fossa (Fig. 22). Medially, it is united at its maxillary border with the malar process of the maxilla and forms the lateral half of the infraorbital margin with its infraorbital process. The flat and wide orbital process unites with the zygomatic border of the squamozygomatic surface of the greater wing of the sphenoid to form the anterolateral wall of the orbit.

Similarly, important features are contributed to the orbit in the basal or verticosubmental view by the malar bone (Fig. 23). The orbital process is shown to form (Fig. 24) a part of the posterolateral margin of the sphenomaxillary (inferior orbital) fissure where it unites with the orbital surface of the greater wing of the sphenoid (Fig. 25). By separating the zygoma from the maxilla, the exact extent of its relation with this bone can be demonstrated. Likewise, the articulations of the frontal and temporal processes are clearly shown. In Figures 26 and 27 the



26 MALAR BONE COMPONENTS OF THE ORBIT


SUPRAORBITAL MARGIN
INFRAORBITAL MARGIN
POSTLATERAL WALL OF ANTRUM
INFERIOR ORBITAL FISSURE
INFERIOR MARGIN ORBITAL SURFACE GREATER WING
SUPERIOR MARGIN ORBITAL SURFACE GREATER WING
SUTURE BETWEEN ORBITAL SURFACE ZYGOMA AND ORBITAL SURFACE GREATER WING

27 THE ORBIT IN THE BASAL VIEW

Figures 26 and 27

appearance of the zygoma in the basal view and its relations with contiguous structures are clearly indicated. Particularly noteworthy are the various appearances shown of the union of the orbital process of the zygoma and the orbital surface of the greater wing where they form

clinoid is seen to mark exactly the site of another apparent foramen occasionally seen alongside the optic foramen. Such a foramen has been referred to as a "bifid optic foramen," especially in England, but is in fact not a foramen at all. In Figure 30 three apparent foramina are shown, but

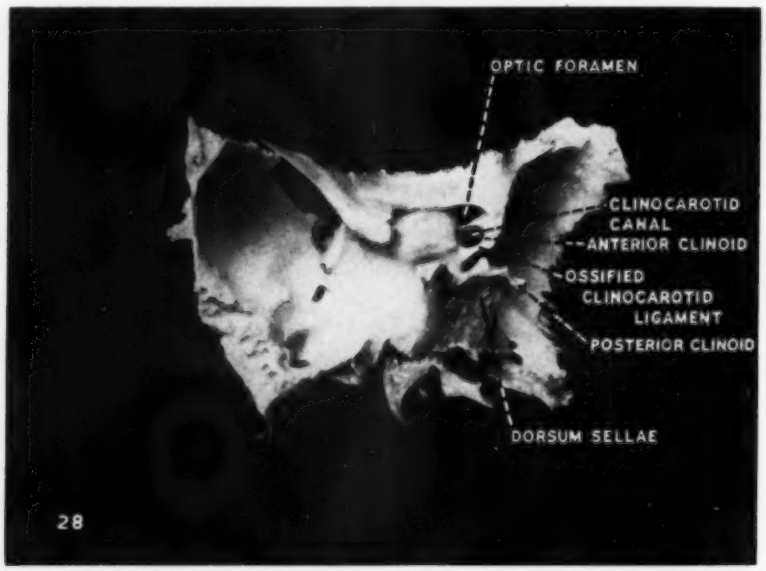


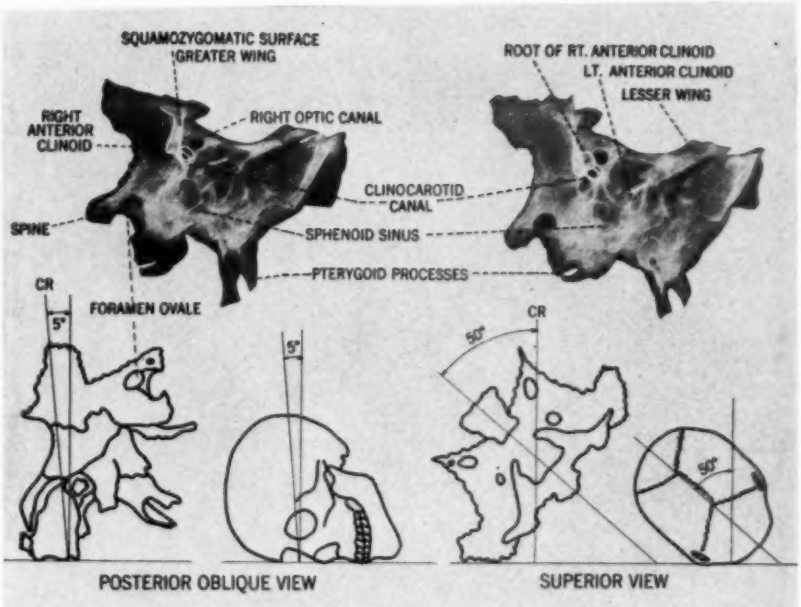
Figure 28

the posterior boundary of the inferior orbital fissure.

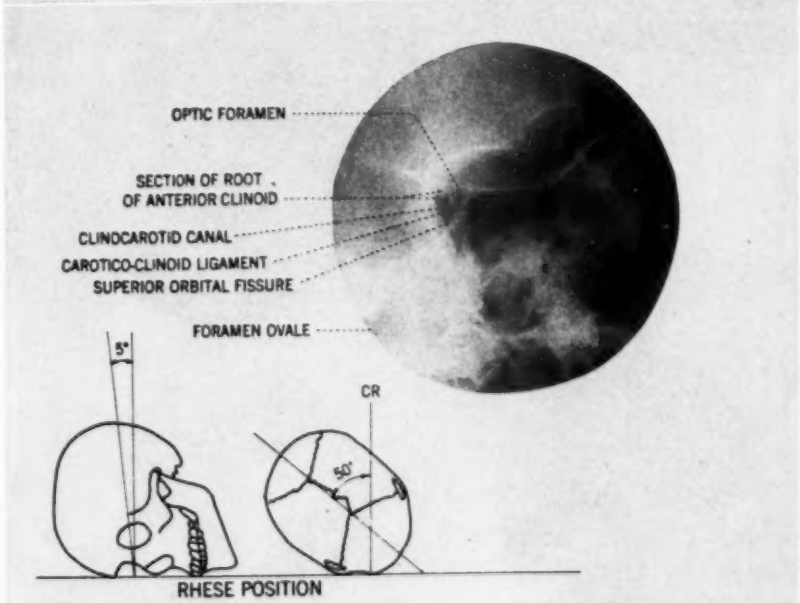
The separate sphenoid bone placed in the position (Rhese) for showing the optic foramen presents some interesting features. Especially is this so of the specimen under study, as it presents an unusual variation—a clinocarotid (carotico-clinoid) foramen which is formed by ossification of a ligament extending between the anterior clinoid and middle clinoid processes (Fig. 28). From this picture it is easy to understand why two foramina are seen. In Figure 29 the position of the clinocarotid foramen is shown, by lead rings placed within it, to be obliquely below the optic foramen and superimposed upon the superior orbital fissure. Also, a lead ring placed around the base of the anterior

only the optic foramen, which is the medial of the two, and the clinocarotid are real ones. The third is a pseudo-foramen formed by the tangential projection of the base of a pneumatized anterior clinoid process (Fig. 31). If the anterior clinoid is dense, then a sclerosed oval or rounded shadow is formed. When present, the clinocarotid canal is frequently visualized in the lateral view (Fig. 32).

The more one studies this subject the more is seen to be investigated. This has been an attempt to cover some of the salient features of the roentgen anatomy of the orbit and is not felt to be the last word on the matter. There is much yet to be done, but it is hoped some small part has been contributed to a better understanding of the radiologic anatomy of the orbit.

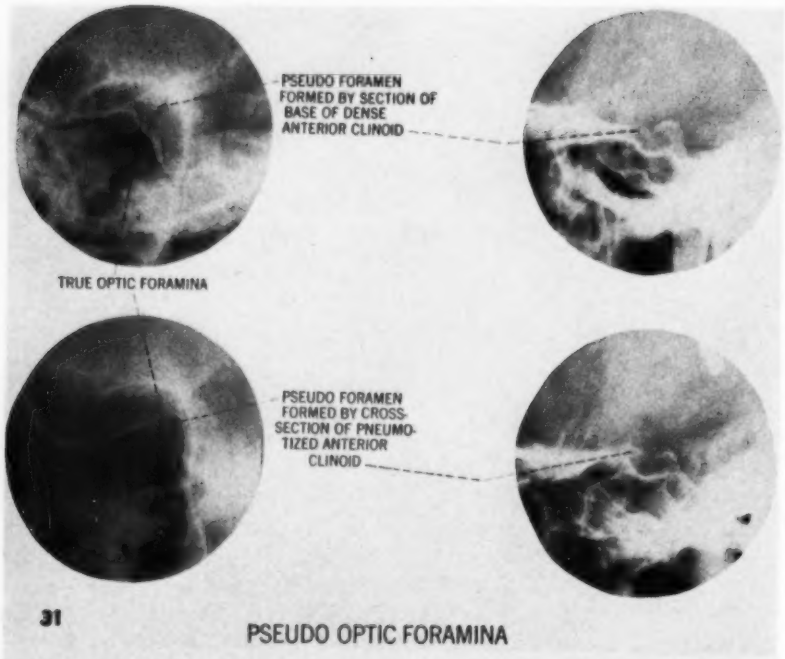


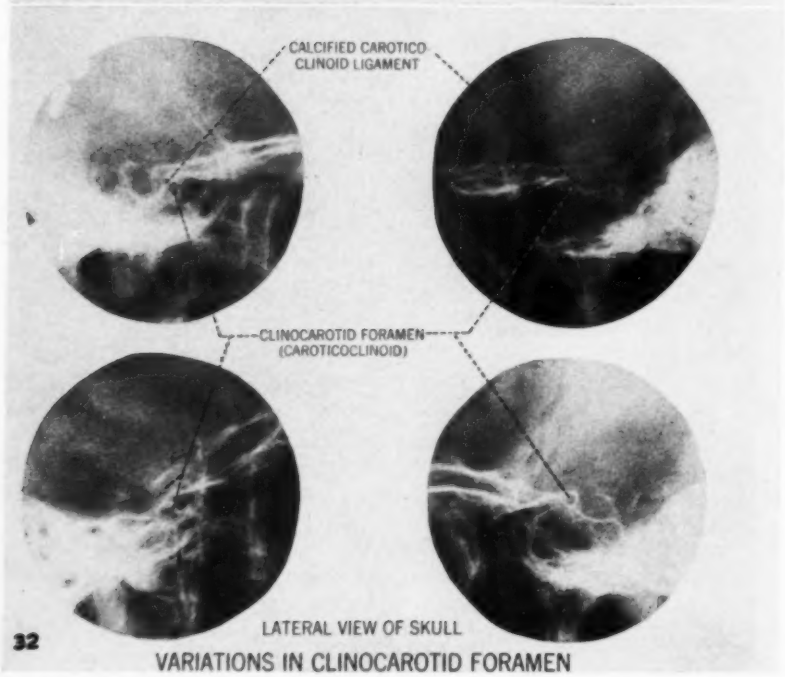
29 SPHENOID BONE AND OPTIC CANAL



30 VARIATIONS IN OPTIC FORAMEN

Figures 29 and 30


PSEUDO FORAMEN FORMED BY SECTION OF BASE OF DENSE ANTERIOR CLINOID
TRUE OPTIC FORAMINA
PSEUDO FORAMEN FORMED BY CROSS-SECTION OF PNEUMO-TIZED ANTERIOR CLINOID
31
PSEUDO OPTIC FORAMINA



Figures 31 and 32

SUMARIO

Anatomía Roentgenologica Pormenorizada de la Orbita

Una serie de grabados, acompañados de breves comentarios, revela con todo pormenor la anatomía roentgenológica de las órbitas de los ojos. Las cavidades piramidales de debajo de la frente están formadas por los huesos frontal, esfenoides, malares, maxilares, etmoides, unguis y palatinos. En la órbita se encuentran bastantes de los pormenores radiográficos que hay que considerar en todo estudio del cráneo.

Eosinophilic Granuloma of the Lung[1]

ROBERT W. LACKEY, LT. COL., M.C., U.S.A., FRANK Y. LEAVER, COL., M.C., U.S.A., and CHARLES J. FARINACCI, COL., M.C., U.S.A.

Denver, Colo.

EOSINOPHILIC granuloma limited to the lung has not to our knowledge been previously reported. Two histologically proved cases recently observed, and carefully followed, are recorded in the following pages. Eosinophilic granuloma involving both lung and bone, diagnosed by biopsy of the osseous lesions, has been reported on three occasions (6, 8, 9). To these three cases another is added. The cases presented here have all been confirmed by surgical biopsy and histologic study. This, we believe, is the first report of histologic confirmation of the lung lesion.

Finzi (1), in 1929, recorded the first case of eosinophilic granuloma of the bone. His diagnosis was "a myeloma with preponderance of eosinophilic cells." Otani and Ehrlich (5) and Lichtenstein and Jaffe (3) established the condition as an entity in 1940. Since these early descriptions there has been a tendency to expand the entity to include cases in which there are multiple bone lesions and even extra-osseous lesions, such as those involving lymph nodes, skin, lungs, and other organs (2). We feel that with the present report a further step is taken in this direction.

EOSINOPHILIC GRANULOMA LIMITED TO THE LUNG

CASE I: A 32-year-old white male had a chronic cough developing during the winter of 1948–49, with the production of 50 to 120 c.c. of sputum daily. He complained of fatigue and night sweats but denied having fever or chills. A provisional diagnosis of pulmonary tuberculosis was made and he was admitted to Fitzsimons Army Hospital. He had lost 40 pounds in weight. He gave a history of dust exposure from September 1947 to January 1948.

Physical examination was negative except for the presence of râles in both lungs.

X-ray examination revealed a diffuse and patchy granulomatous type of pulmonary infiltrate (Fig. 1) widely disseminated throughout both lung fields, showing a peculiar nodular quality. The nodules ranged in size from almost miliary dimensions to 1.5 cm. in diameter. Their margins were hazy. They were made more apparent, or striking, by scattered areas of lucency interpreted as emphysema. In the background, throughout, the films showed a mild degree of fibrosis.

The total white blood count was 18,500, with 83 per cent polymorphonuclear neutrophils but no eosinophils. A tuberculin (PPD, 1st strength) skin reaction was 1 plus; histoplasmin skin reaction 2 plus; coccidioidin skin test negative. Repeated examinations of sputum were negative for acid-fast bacilli and fungi.

On Aug. 24, 1949, a left thoracotomy was performed. Lung tissue from the left lower lobe was submitted for examination.

Gross Examination: The specimen consisted of a wedge of lung tissue measuring 5.0 × 1.5 cm. Hard nodules, the size of a pea, were felt scattered throughout. Over these the pleura was thickened and hyalinized in some areas. The cut surface showed scattered irregular, rounded, grayish-white nodules, the largest one of which measured 1.0 × 0.7 cm. Those that reached the pleura merged with it.

Histologic Examination: Microscopic studies showed a granuloma with an unusual eosinophilic polymorphonuclear infiltrate in the fibrosing miliary lesions (Fig. 2). Many histiocytic cells and xanthomatous macrophages were seen. There were a few lymphocytes and some foreign body giant cells among the fibrous trabeculae. The alveolar architecture in these areas was completely obliterated by fibrous tissue containing eosinophils, pigment-laden macrophages, and histiocytes (see Figs. 5 and 6).

Cultures from the lung tissues were negative for acid-fast bacilli and fungi. No organisms or parasites were demonstrable by special stains.

This lesion had the appearance of an inflammatory granulomatous process rather than one of neoplastic origin. In its histologic components of eosinophils and histiocytes in a fibrous stroma it resembled eosinophilic granuloma of bone.

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[1] From the Department of Radiology (R.W.L., F.Y.L.) and the Department of Pathology (C.J.F.), Fitzsimons Army Hospital, Denver, Colo. Accepted for publication in January 1952.

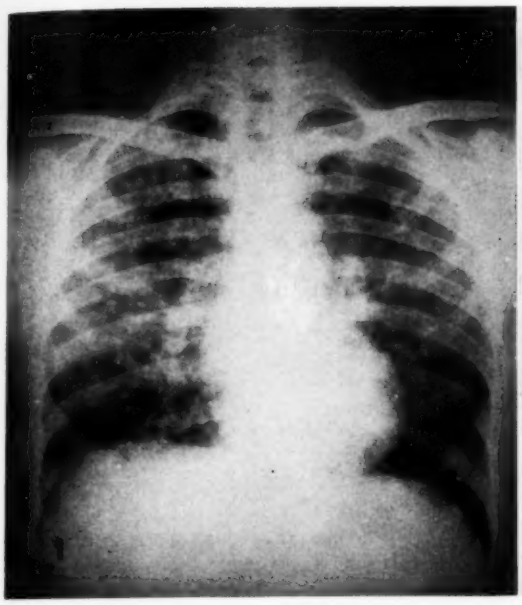

Fig. 1. Case I. Chest on admission, showing a generalized patchy granulomatous infiltrate with components of fibrosis and emphysema.

Fig. 2. Case I. Surgical specimen, under low power, showing the circumscribed granulomatous reaction in the lung tissue.

CASE II: Routine chest examination of a 24-year-old male for re-enlistment in the Army, in September 1950, showed a widely disseminated diffuse and patchy granulomatous type of pulmonary infiltrate throughout all lung fields (Fig. 3). The granulomatous nodules ranged in size from miliary lesions to 1.5 cm. in diameter. Their margins were ill defined and seemed to blend into the surrounding tissue. Scattered areas of lucency throughout were interpreted as localized emphysema. In the background the lungs showed a slight degree of fibrosis.

The patient stated that he had lost 5 or 6 pounds of weight in the preceding eight months but he gave no history of chills, night sweats, fever, hemoptysis, or malaise. During the hospital course, his afternoon temperature varied between 99 and 100° F.

The past history was non-contributory except that the patient had been employed driving a truck carrying dry sand and cement. He had malaria in 1946, with recurrences in 1947 and 1948.

Physical examination was negative except for the presence of a small, non-tender, movable node in the left axilla.

The total white blood count was 14,250, with 60 per cent neutrophils and 10 per cent eosinophils. The red blood count, hemoglobin, and urine were normal. A tuberculin (PPD, 2nd strength) test and skin tests for blastomycosis and histoplasmosis were positive. The coccidioidin skin test and the complement-fixation test for histoplasmosis were negative. Repeated examination of sputum and gastric washings were negative for tuberculosis and fungi.

Repeat chest films obtained on Oct. 24 showed no change. Roentgen examination of the hands and feet revealed no abnormalities, nor were any lesions demonstrable in postoperative x-ray studies of the long bones and skull (Nov. 20).

On Nov. 13 a left thoracotomy was performed. Numerous firm nodules the size of buckshot could be palpated throughout both lobes. The lung surface over these nodules was dimpled. The hilar lymph nodes were not enlarged. Tissue for biopsy was taken from the left upper and lower lobes.

Gross Examination: The specimen consisted of two small pieces of lung tissue in which small, firm (but not stony hard) nodules could be palpated. The cut surface of the nodules was yellow and they were not sharply circumscribed. They varied from 0.4 to 1.5 cm. in diameter. Smears and cultures made from these lesions were negative for tuberculosis and fungi.

Histologic Examination: Microscopically the nodules were seen to be replacing the lung tissue (Fig. 4). They consisted of bands of fibrous tissue containing in a lobulated fashion masses of

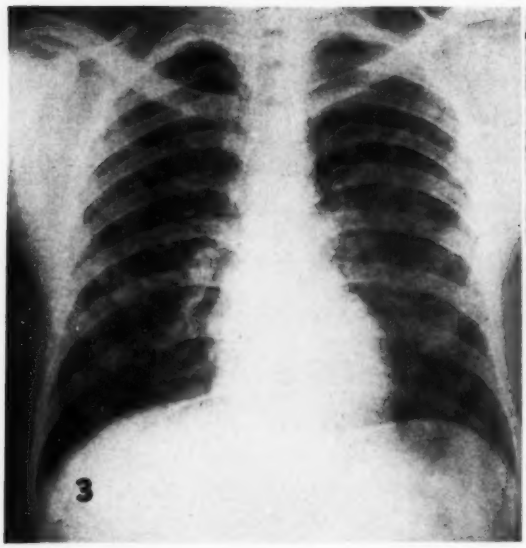

Fig. 3. Case II. Chest on admission, showing an extensive generalized granulomatous infiltrative process in the lungs with a slight degree of fibrosis and scattered areas of emphysema.

Fig. 4. Case II. Surgical specimen, under low power, showing the granulomatous lesion surrounded by relatively normal lung.

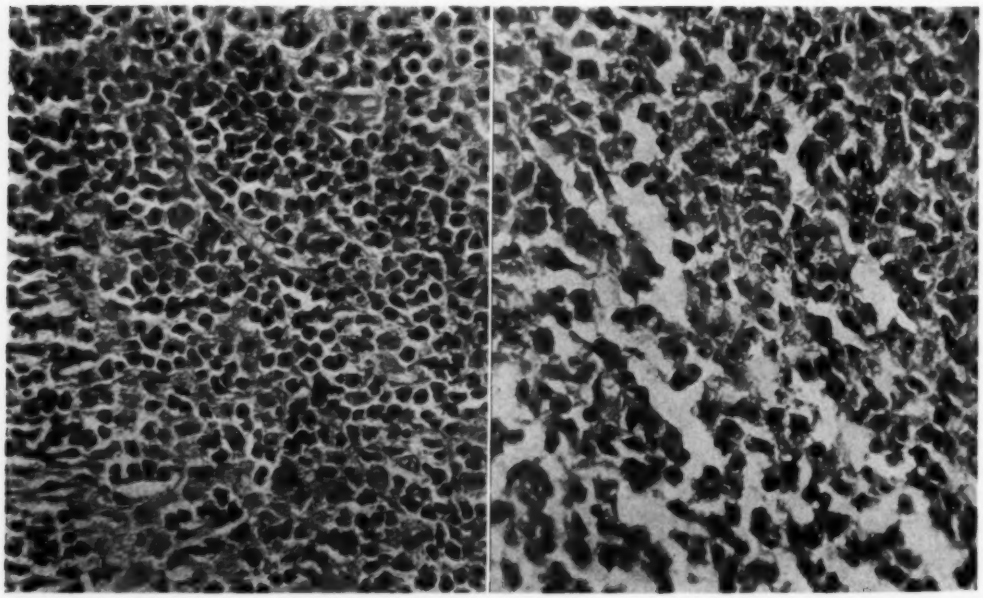

Fig. 5. Case II. Section of the granulomatous lesion shown in Fig. 4, illustrating the large numbers of eosinophils and scattered histiocytes. Microscopic specimens from the granulomatous lesion in Fig. 2 showed an identical pathological picture.

Fig. 6. Case II. Section of the granulomatous lesion shown in Fig. 4. Here the histiocytes predominate but the eosinophils are still numerous. This pattern is identical with microscopic sections of the lesion shown in Fig. 2.

eosinophils and histiocytic cells (Figs. 5 and 6). The histiocytes had large vesicular nuclei and their cytoplasm was fragmented in some instances. In others, the cytoplasm was more abundant and vacuolated. Some large macrophages were laden with brown pigment. Scattered throughout were giant cells formed of nuclear aggregations with little cytoplasm. Occasionally typical foreign-body giant cells were seen. The eosinophils, mostly of the mature type, were numerous and in some areas appeared in large clumps.

The granulomatous process was not circumscribed, but in the sections one noted areas of lung wherein the architecture was completely destroyed, adjacent areas which were atelectatic, and then normal or slightly emphysematous appearing lung tissue. No organisms or parasites were demonstrated by special staining technics at the Armed Forces Institute of Pathology.

Fig. 7. Enlarged area of the right upper thorax in Case I, showing clearly the granulomatous infiltrate together with the background of emphysema and fibrosis.

Clinical Picture

In both of these cases the clinical picture was minimal. Both patients complained of a mild cigarette cough with some sputum production. There was a low-grade afternoon temperature of 99 to 100°. There was no chest pain and only slight fatigue. In Case II the condition was discovered entirely by accident. Physical findings were limited to Case I, in which scattered râles were found throughout the chest. In other words, the clinical picture is that of a very benign condition, belying the striking roentgen changes.

Roentgen Findings

The lung findings in this condition are generalized and widespread. They were identical in both cases (Figs. 1 and 3). They consist of a granulomatous infiltrate, nodular in character, the nodules varying in size from miliary dimensions up to 1.5 cm. in diameter (Fig. 7). They are not sharply demarcated but have rather hazy borders fading into the normal lung tissue surrounding them. There is evidence of associated localized areas of emphysema and fibrosis.

Pathological Picture

Both cases showed the same pathological picture, that of granulomatous lesions, multiple and widely disseminated, not sharply circumscribed. There are areas showing fibrous tissue reaction, pigment-laden macrophages, and histiocytes. Eosinophils are a prominent feature, being present both as scattered individual cells and, in some areas, in sheets and large clumps. The picture is identical with that seen in eosinophilic granuloma of bone.

Differential Diagnosis

Since clinical and laboratory findings in these cases are more or less negative, we are limited in our discussion to a differential diagnosis of the above-described roentgen picture. To be considered are those conditions which give rise to (*a*) diffuse nodular granulomatous pulmonary infiltrate, (*b*) pulmonary fibrosis, and (*c*) emphysema of a scattered segmented type. This pattern has been described in various papers and the differential diagnosis suggested. Most recently Robbins (7) touched upon the subject in his discussion of idiopathic pulmonary fibrosis. Perhaps, however, the most classic description is to be found in a paper by Oswald and Parkinson (4) on honeycomb lungs. Both of these writers give the impression that differentiation lies between those conditions, more or less well known, that produce the above-mentioned pathological changes in the lungs.

Tuberculosis: When one is confronted with a roentgenogram of pulmonary eosino-

philic granuloma (Figs. 1 and 3), tuberculosis certainly must be considered. It may be ruled out with a fair degree of certainty because of the clinical picture (the eosinophilic granulomatous patient is almost asymptomatic) and the absence of acid-fast organisms in the sputum (in view of the extensive lung involvement shown on the roentgenogram).

Sarcoidosis may present a difficult differential problem. It is to be confessed that preoperatively this was the diagnosis in the two cases cited above. Absence of hilar and peritracheal adenopathy is, however, suggestive of another diagnosis. Also, the pulmonary infiltrate in eosinophilic granuloma is more widely disseminated than that usually encountrede in sarcoid, having a hematogenous rather than a lymphogenous distribution in the lung fields. These two factors, added to the underlying or background pattern of fibrosis and emphysema seen in cases of eosinophilic granuloma, are strongly opposed to a diagnosis of sarcoid.

Pneumoconiosis: The lesions in pneumoconiosis are seldom generalized or evenly distributed throughout the lungs, strongly favoring the hilar regions and the apices. Hilar masses are not uncommon, and calcification, particularly of the egg-shell type, is the usual finding when the roentgenograms show as extensive changes as are seen in eosinophilic granuloma. The history may, of course, settle the issue.

Bronchiectasis is to be considered, but in most instances may be ruled out on the basis of the clinical history and physical findings. The roentgen picture may be confused only with a very advanced generalized saccular type of bronchiectasis, in which the symptoms and clinical findings should be pronounced. Bronchography would definitely eliminate this diagnosis, but was not considered in any of our cases.

Hodgkin's disease and other lymphomata seldom produce the extensive pulmonary changes seen in eosinophilic granuloma without showing some evidence of lymph node involvement, either hilar or peripheral. The components of fibrosis and emphysema are usually absent in these conditions. A lymph node biopsy will usually establish the diagnosis.

Periarteritis nodosa: In periarteritis nodosa the lung findings do not usually present the picture seen in eosinophilic granuloma, being more in the nature of a miliary peribronchial infiltrate sparing the periphery of the lung fields. The clinical observations will usually enable one to make the differential diagnosis. Periarteritis nodosa is a generalized disease, with kidney involvement in 75 per cent of the cases, heart changes in 60 per cent, and complaints referable to the gastro-intestinal tract in 30 per cent, while lung changes occur in only 5 per cent.

Rheumatic fever and Loeffler's syndrome may be ruled out on the basis of the clinical findings and the transitory nature of the radiographic changes.

Scleroderma: The clinical picture also helps to rule out scleroderma, although the lungs may show a diffuse fibrotic "honeycomb" appearance.

Erythema nodosum may present a diffuse mottling of the lung fields with associated fibrosis, but is not likely to be confused with eosinophilic granuloma. The clinical course is acute, and the skin manifestations make the diagnosis clear.

Fibrocystic disease of the pancreas is characterized by fibrosis and emphysema of the lungs, but its clinical picture and lack of nodulation in the lung fields serve to distinguish it from eosinophilic granuloma.

Coccidioidomycosis: Here, as in tuberculosis, the organisms should be found in the sputum in the presence of such extensive radiographic involvement of the lungs. Furthermore, the clinical findings in eosinophilic granuloma certainly are not compatible with extensive coccidioidomycosis of the lung. Coccidioidin skin tests and complement-fixation tests may assume an important role in confirming the clinical impression.

Histoplasmosis usually does not present the fibrosis and emphysema seen in eosinophilic granuloma. It may be definitely ruled out by the histoplasmin skin test.

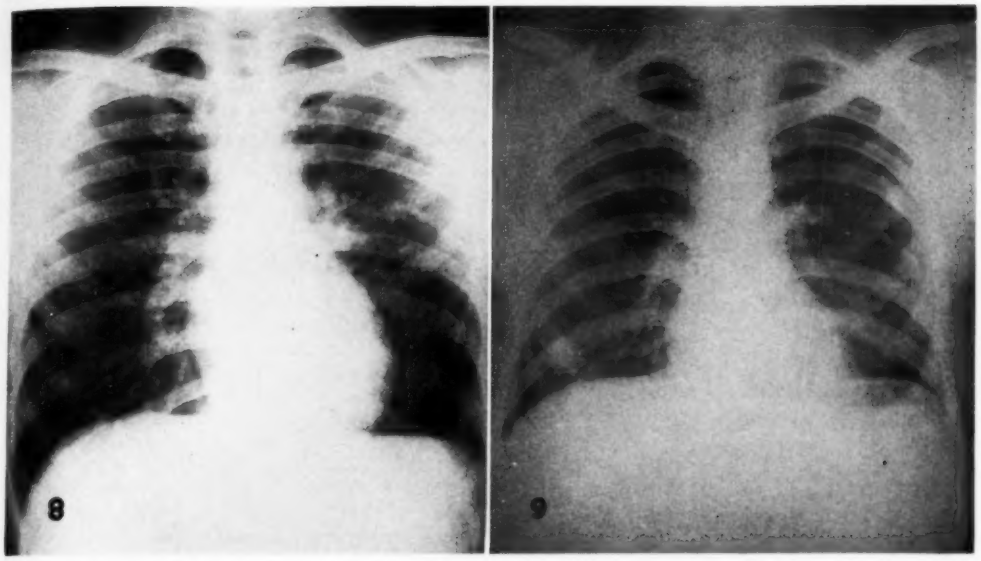

Fig. 8. Chest in Case I, sixteen months after thoracotomy, showing considerable clearing as compared with Fig. 1. Some residual fibrosis is evident.

Fig. 9. Chest in Case II, six months after admission to the hospital. There is definite evidence of clearing of the process, but some of the infiltrate remains. Compare with Fig. 3.

If there is any doubt, blood cultures for *Histoplasma capsulatum* may be carried out, as well as inoculations of mice with bronchial material.

Amyloidosis is a very rare disease which may be ruled out by clinical and laboratory studies. Involvement of the liver or kidneys, seen in this condition, is not present in eosinophilic granuloma.

Leukemia shows fine miliary lesions instead of the nodules seen in eosinophilic granuloma. There is usually no fibrosis or emphysema. Blood studies will establish the diagnosis.

Pulmonary adenomatosis is a generalized nodose condition of the lungs but it does not show the fibrotic or emphysematous components of eosinophilic granuloma. The patient is usually dyspneic and acutely ill, and the condition is progressive rather than static.

Xanthomatoses or Reticuloses: This is the group of diseases that includes eosinophilic granuloma. Patients with pulmonary involvement in any of these conditions, whether of lipoid or non-lipoid type, show roentgenographically the same diffuse pattern of fibrosis, emphysema, and granulomatous infiltrate. The radiographic picture is identical in the entire group of the xanthomas and, like the pathological findings, is almost inseparable from that of Letterer-Siwe and Hand-Schüller-Christian disease.

Of the lipoid xanthomatoses, Gaucher's disease and Niemann-Pick's disease may be ruled out by studies of the blood cholesterols, since they show hypercholesteremia. In addition, Niemann-Pick's disease is characterized by enlargement of the liver, spleen, and lymph nodes, anemia, and leukocytosis. Gaucher's disease is more common in Jewish females in the first decade. It is of insidious onset and chronic, with marked splenic enlargement, a pancytopenia due to bone marrow replacement, and/or hypersplenism with resulting purpura. X-ray studies show a pathognomonic widening (Erlenmeyer flask type) of the lower end of the femur.

The non-lipoid group includes Letterer-Siwe disease, Hand-Schüller-Christian dis-

ease, and eosinophilic granuloma. Letterer Siwe disease is found almost exclusively in infants and is characterized by generalized involvement of the spleen, liver, lymph nodes, lungs, and bones. It is progressive and fatal. Patients with Hand-Schüller-Christian disease clinically show diabetes insipidus in many instances, as well as exophthalmos, which is usually unilateral. Defects in the skull bones together with multiple areas of involvement of other bones are usual. The liver, spleen, and lungs are involved in various degrees. Anemia is frequent. The disease is progressive and usually fatal.

Treatment and Follow-Up

In Case I the eosinophilic granuloma was untreated. The pulmonary status was carefully followed by roentgen studies, and the lungs have gradually cleared. The last film, obtained Dec. 12, 1950 (Fig. 8), approximately sixteen months after thoracotomy, shows almost complete clearing, with some residual fibrosis. The second patient received ACTH (800 mg., Nov. 30—Dec. 9) and cortisone (5,700 mg. Dec. 10–Feb. 23). A chest film taken some six months after admission to the hospital shows definite evidence of clearing of the process (Fig. 9), but at the date of writing some of the granulomatous infiltrate is still present and the fibrosis is unchanged. The progress of these cases is very important, as it is in this respect that the benign nature of eosinophilic granuloma is manifest as compared to Letterer-Siwe and Hand-Schüller-Christian disease. The chronicity is also demonstrated, as compared to the more transient Loeffler's pneumonia. The course of the disease in the two patients described agrees in every respect with the course in patients having monostotic eosinophilic granuloma of bone.

EOSINOPHILIC GRANULOMA OF THE LUNG IN ASSOCIATION WITH EOSINOPHILIC GRANULOMA OF BONE

The pulmonary pattern described above for eosinophilic granuloma has been mentioned several times in the literature. Three authors have reported its presence in cases of eosinophilic granuloma of bone proved by biopsy. To this group another case is added. In none of these cases was lung biopsy performed, and it can only be inferred that the lung lesions are of the same nature as those found in the bones.

CASE III: A 19-year-old white male was admitted to Fitzsimons Army Hospital on May 24, 1950, with a history dating back to November 1949, when he noted a soreness of the right lower gum margin. On Dec. 1, 1949, he experienced general malaise, fatigability, pain in both shoulders, and over the anterior chest. Chest pain was aggravated by coughing and deep inspiration and was associated with a nonproductive cough as well as a 20-pound weight loss. On Jan. 11, 1950, the patient reported to the dental clinic because of continued gingival pain. X-ray examination revealed destruction of the alveolar half of the mandible. Because of poor healing following the extraction of two loosened teeth, hospitalization was effected on March 16. Roentgenographically the upper border of the mandible was found to be eroded and reduced to two-thirds of normal, with the bony outline hazy and irregular. The patient's weight fluctuated between 126 and 128 pounds and he had a daily temperature elevation of 99 to 99.6°. On March 23 a painless swelling, not accompanied by inflammation, appeared over the anterior end of the first rib. Following poor results with antibiotic therapy, a presumptive diagnosis of actinomycosis was made and the patient was evacuated to Fitzsimons Army Hospital.

Positive findings were limited to the mouth and the chest. There were white, non-elevated, tender coalescent areas over the gingivae, with areas of apparent necrosis in the region of the previous tooth extraction. Scattered râles were present in both lungs.

Laboratory examinations showed a leukocyte count of 12,000, with 73 per cent polymorphonuclears and 1 per cent eosinophils. Tuberculin, histoplasmin, actinomycin, and coccidioidin skin tests were negative. Sputum and exudate from the gingivae were culturally positive for Vincent's *Spirella* and fusiform bacilli.

Roentgen examinations revealed: (1) destructive lesions of the bone of both mandibles (Fig. 10); (2) cyst-like destructive lesion of the anterior third of the left first rib, with expansion of, but no break in, the cortex (Fig. 12); (3) cyst-like areas of loss of bone substance in the proximal ends of the shafts of the humeri involving the heads (Figs. 11 and 12); (4) a similar lesion in the left scapula (Fig. 11); (5) a general diffuse granulo-

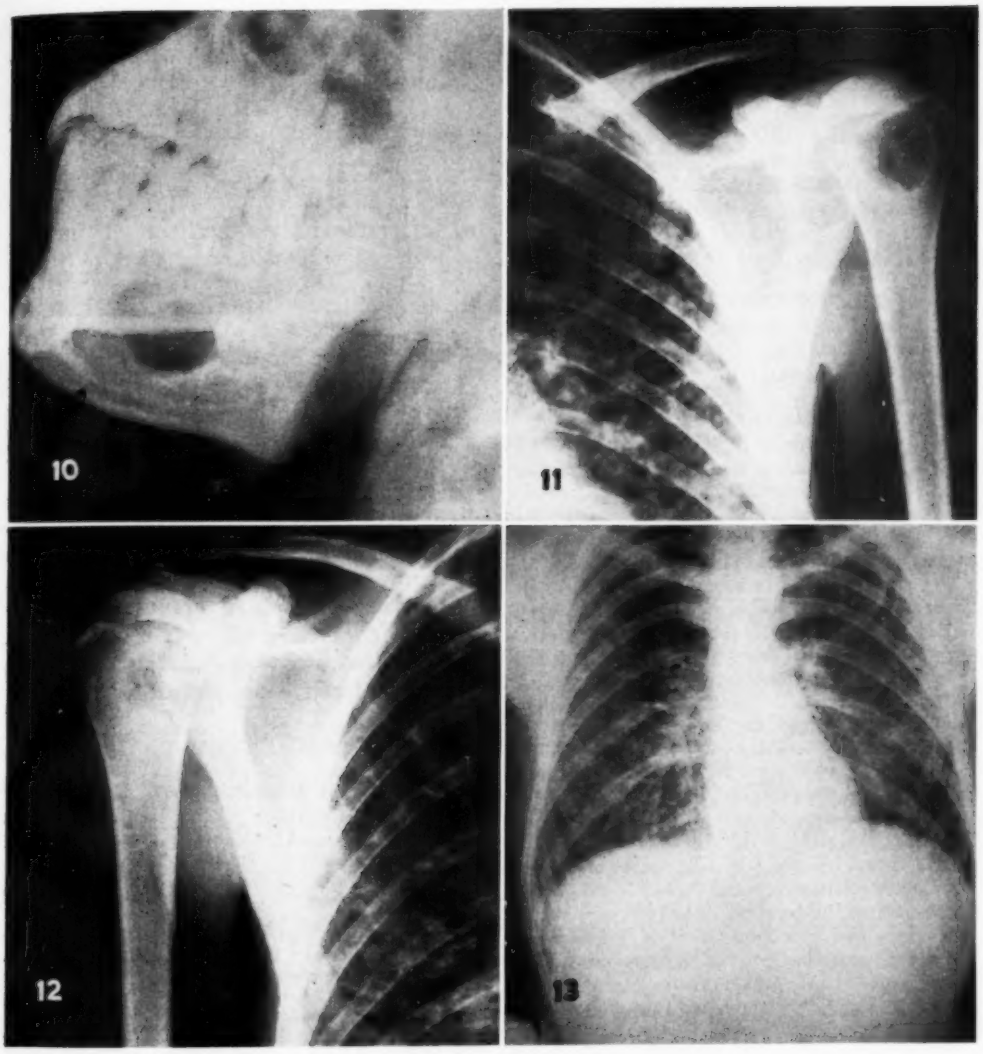

Fig. 10. Left mandible, showing destructive lesion of the bone. A similar lesion was present in the right mandible.
Fig. 11. Right shoulder, showing a cyst-like area of destruction in the proximal end of the humerus.
Fig. 12. Left shoulder, showing a cyst-like destructive lesion in the proximal end of the humerus. A similar lesion is seen in the glenoid process of the scapula. The cystic destructive lesion involving the anterior third of the left first rib is also seen, showing the expansion of the cortex.
Fig. 13. The diffuse granulomatous pulmonary lesions are quite prominent, as are the fibrosis and emphysema of the lung.

matous nodular pulmonary infiltrate throughout all lung fields (Fig. 13). The nodules ranged in size from miliary lesions to 1.5 cm. in diameter. There was a rather widely disseminated pulmonary emphysema, which in areas showed cystic formation. Over the left apex was a localized area of pneumothorax (this cleared within a week). Fibrosis, as a background, was rather pronounced and generalized (Fig. 13).

The course in the hospital was characterized by daily temperature elevations to 99 and 99.8° and a slight weight gain. Gingival biopsy on June 6, 1950, showed eosinophilic granuloma.

Gross Examination: The biopsy specimen consisted of a small wedge-shaped piece of formalin-fixed, firm tissue measuring 9 × 6 × 4 mm., which appeared to be covered on one surface by mucous membrane.

Histologic Examination: The stratified squamous epithelial surface was in places ulcerated and covered by a fibrinopurulent exudate. In the submucosal tissue was a severe infiltration by large, swollen histiocytic cells, clumps of eosinophils, some plasma cells, lymphocytes, and polymorphonuclear neutrophils. The histologic features were typical of eosinophilic granuloma.

Treatment: This patient received roentgen therapy, with the following factors: 200 kv., 15 ma.; 0.5 mm. Cu and 1.0 mm. Al added filtration, 50 cm. F.S.D., h.v.l. 1.1 mm. Cu. The treatment plan consisted in delivering one or two courses of 600 r in air to each port at the rate of 200 r in air each day.

Two courses were given to the chest, July 17–Aug. 22, 1950, and Dec. 28, 1950–Jan. 11, 1951. The entire chest was treated through 4 anterior and 4 posterior ports, 15 × 15 cm. each. The right and left shoulders also received two courses, July 17–25, 1950, and Jan. 16–22, 1951, an anterior and posterior port, 10 × 10 cm., being used over each shoulder. A single course was given to the right and left mandible, July 25–Aug. 2, 1950, through ports measuring 3 × 8 cm., and two courses, Sept. 26–30, 1950, and Jan. 16–18, 1951, to the right and left maxillae through 3 × 5 cm. cones. A single course was administered to a 7-cm. circular sublingular field, Jan. 12–15, 1951.

The lesions along the lower gingival margins had shown considerable regression at the time of this report, but two new lesions had appeared in the upper gingivae, involving the maxilla as evidenced by surgical exploration and roentgenograms. In March 1951, a new lesion appeared on the lower gingival margin anteriorly. The pulmonary picture remained unchanged, as did the lesions in the humeri. The rib lesion showed signs of regression and reossification. At the time of the report the patient had been asymptomatic, except for slight temperature elevation, six months. He had no cough and raised no sputum.

It is felt that this case, in view of the close resemblance of the pulmonary radiographic findings to those in Cases I and II, represents eosinophilic granuloma of the lung. It is believed, also, that the cases reported by Weinstein (9), Schuknecht (8) and Parkinson (6) are examples of this condition.

SUMMARY

Two cases of eosinophilic granuloma limited to the lungs have been described, along with an additional case of eosinophilic granuloma of bone with pulmonary findings.

The roentgenologic picture is identical with that of Letterer-Siwe disease, Hand-Schüller-Christian disease, Gaucher's disease, and other xanthomatoses, consisting of a granulomatous infiltrate of nodular character, with associated localized areas of emphysema, and a slightly fibrotic background. The clinical manifestations are mild.

Histopathologically the lesions in the lungs are identical with eosinophilic granuloma of bone.

It is suggested that the two cases of localized pulmonary eosinophilic granuloma, like eosinophilic granuloma of bone, represent a monosymptomatic form of a systemic xanthomatous disorder, and that the term eosinophilic granuloma be expanded to include those cases in which there are extra-osseous lesions such as those involving lungs, skin, and other organs.

Station Hospital
Fort Riley, Kans.

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SUMARIO

Granuloma Eosinófilo del Pulmón

Descríbense 2 casos de granuloma eosinófilo limitado a los pulmones, junto con otro caso de granuloma eosinó filo del hueso con manifestaciones pulmonares.

El cuadro roentgenológico es idéntico al de la enfermedad de Letterer-Siwe, la enfermedad de Hand-Schüller-Christian, la enfermedad de Gaucher y otras xantomatosis, consistiendo en infiltrado granulomatoso de naturaleza nodular, unido a zonas localizadas de enfisema y fondo ligeramente fibroso. Las manifestaciones clínicas son leves.

Histológicamente, las lesiones pulmonares son idénticas a las del granuloma eosinófilo del hueso.

Apúntase que los 2 casos de granuloma eosinófilo localizado en el pulmón, lo mismo que el caso de granuloma eosinófilo del hueso, representan una forma monosintomática de trastorno xantomatoso orgánico, y que debe ampliarse el término de granuloma eosinófilo para abarcar los casos en que existen lesiones extraóseas, como las que afectan los pulmones, la piel y otros órganos.

Diagnosis and Localization of Organic Lesions of the Central Nervous System Using Radioactive Diiodofluorescein[1]

LOYAL DAVIS, M.D., and STANTON L. GOLDSTEIN, M.D.

Chicago, Ill.

IN 1911, it was said that fluorescein had a special affinity for tumor cells. At that time, Wasserman used peptobromofluorescein (eosin) as a vehicle to carry toxic selenium to the tumor for chemotherapeutic purposes. It was not until 1929 and 1931 that there was a renewed interest in the use of fluorescein, when Copeman and his co-workers used sodium fluorescein, both topically and intravenously, in conjunction with high-voltage roentgen therapy or radium, in the study and treatment of tumors of the breast and bone. Fluorescein was used primarily, however, in the study of capillary permeability in diseases of the central nervous system, in the study of the blood-aqueous humor barrier, and in investigations of the circulation time.

Experimental studies on neoplastic growths in lower animals indicate that other vital dyes localize selectively in the cancer tissue, not in the cancer cell itself but in the intercellular stroma, probably as a result of the altered permeability of the stromal blood vessels. Localization of the dye in active non-necrotic portions of the tumor tissue takes place rapidly, within one-half hour after intravenous administration.

It has been noted, from studies of the distribution of radioactive iodinated trypan blue and other dye preparations in tumor-bearing mice, that tumor tissue shows a concentration of radioactivity several times higher than skeletal muscle or skin, but much lower than the liver, spleen, and kidneys. The localization of acid dyes other than fluorescein has been investigated in animal tumors and they appear to be taken up selectively in neoplastic foci, dependent on a factor associated with a local increase in capillary permeability to the dye. In 1940, it was demonstrated that fluorescein is an acid-diffusible dye, about 40 per cent of which is bound to blood proteins and is not diffusible unless the permeability of the capillaries is altered. The other 60 per cent may be found in the body fluids in direct proportion to its concentration in the blood. It is rapidly excreted by the kidney and by the salivary glands and sweat glands.

It was not until 1947 that Moore and his associates first used fluorescein as an agent in the differentiation of normal and neoplastic human tissues. In an initial report upon 15 patients, they demonstrated the clinical usefulness of iodine^{131}-labeled fluorescein in the diagnosis and localization of brain tumors. Tabern then developed a method for the production of stable diiodofluorescein which contained no free iodine^{131} or other iodinated fluorescein compounds.

We have utilized radioactive diiodofluorescein in the study of 536 patients with the diagnosis of an intracranial lesion and have correlated our observations with the preoperative clinical diagnosis, electroencephalography, pneumography, angiography, and surgical and autopsy observations. We have made postoperative and postirradiation tests and, finally, we have correlated all these studies with the histopathological characteristics of the tumors. The results indicate that this radioactive isotope dye test is a valuable diagnostic adjunct in neurosurgical problems not only because of its high degree of accuracy in determining the presence of brain tumors but also because of its relatively precise focal localization. The possibility of prognosticating in a general fashion the relative degree of cellularity

[1] Presented at the Thirty-seventh Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 2–7, 1951.

and vascularity of the tumor also appears to be feasible.

Approximately 1.1 millicuries of the radioactive dye contained in a sterile 8 to 10 per cent solution is injected intravenously, with appropriate radioisotopic precautions to prevent contamination of the skin of the patient and operator. The uptake in the brain is then determined by external counting with the aid of a single-channel differential radiation localizer. This radiation detection equipment consists of four major components:

(1) A mica-window Geiger-Müller tube with a 250 mg./cm². aluminum cap which effectively eliminates most of the I^{131} beta radiations.

(2) A lead shield in which the tube is mounted. This shield extends 1.5 cm. beyond the end of the Geiger tube, providing for a wide geometry. Maximum flexibility is achieved by attaching the shield and the tube to a 360-degree yoke and swivel, which in turn is set on a wall-mounted dental x-ray tube arm.

(3) A counting rate meter, with a 1,000 count per minute full scale range, connected to the tube through a preamplifier.

(4) A mechanical graphic recorder with a recording speed of 6 minutes per inch.

The survey covers at least 32 different positions on the scalp, including 13 areas symmetrically studied on each side of the skull, alternating from left to right, and 6 midline positions. In this fashion every inch of the skull on and above Reid's base line is surveyed with the counter. The Geiger-Müller tube is placed directly on the scalp and is maintained at right angles to the tangent at the particular position under study. Readings are of at least three minutes duration over each site and are repeated over abnormal areas at frequent intervals of time from twenty minutes to four hours after injection of the dye. The counts per minute are visually displayed and continuously recorded, so that the abnormal concentrations can readily be diagrammatically transposed and recorded on a pictorial chart.

Within a minute or two after the injection of the dye, the radioactivity at the surface of the head is at a maximum. This decreases rapidly over the next ten to thirty minutes, until a plateau is observed. After this interval, and for the next one to two hours, the decline in counts is gradual, so that symmetric positions can be accurately studied, if care is taken in properly matching areas on each side of the skull within three to five minutes. The most significant counting rates occur within one-half to two hours after the administration of the radiodye; hence, suspected areas of involvement not only must be rechecked several times during this period, but comparisons must also be made with concentrations in adjacent areas, in order to delineate not only the main focus of the lesion but also its extent. The counting rates during this pertinent period, with the equipment described, are of the order of magnitude of 200 to 1,200 counts per minute.

It is essential to count at least all 32 sites, but, since there is only a limited significant time interval of about two hours, the order of the performance of the counting should vary so that the suspected areas are measured at least two to three times for greater accuracy. At the end of three to four hours the readings are only confirmatory, for the differential concentrations are no longer striking.

A range of normal concentrations has been determined for each position at various time intervals. If the observed concentration at all sites is greater than the upper range of normal by 100 to 600 counts per minute, then a tumor should be suspected. For localization of this tumor, comparisons are then made with the symmetric position on the opposite side of the skull and also with positions adjacent to the area under suspicion. In the normal subject, the counts made over symmetric sites vary from 0 to 40 counts per minute. Hence, 50 counts per minute is arbitrarily considered to be the lowest level of significance. The standard statistical error at rates of 500 to 1,000 counts per minute is 20 and 30 counts per minute, respectively.

Therefore, variations of more than 10 to 15 per cent are significant. It should be noted that the over-all increase of radioactivity in patients with verified brain tumors may be such that the count over the tumor itself may be 50 to 100 per cent greater than the count over the same site in a normal brain, at a comparable time interval.

The selective deposition of the radioactive dye within tumor tissue appears to depend mainly upon the state of the capillary endothelium, and concentrations of the dye are directly proportional to the angio-architectural histopathological patterns. Previous experimental studies have proved that changes in endothelial permeability permit the exudation of foreign substances, such as vital dyes, and our studies tend to confirm these older observations. It is also possible that the increased cellularity of a tumor may also be responsible for the increased uptake of the radioactive fluorescein. This may be due either to an intracellular enzyme, or to a "spreading factor," or an hyaluronidase-like substance, which has its effect upon the cement substance between the endothelial cells of the terminal capillaries, thereby secondarily increasing their permeability.

Contrary to the impressions of Moore and his associates, we believe that the degree of vascularity of a lesion is a major factor, because in our studies the highest radioactive fluorescein concentrations occur within the first hour after administration. We believe that it is the endothelium of the terminal capillaries which is of major importance, and not that of the larger blood vessels, since the latter do not share in the nutritional balance of the tissues and since we have been able to demonstrate that intracranial aneurysms yield relatively normal radiodye studies.

Our *in vitro* biopsy studies upon tumor tissue removed at surgery also show that the more vascular and more cellular tumors have higher radioactivity than the relatively avascular and acellular ones, and that cysts yield even less radioactivity than the normal brain.

If the observed concentrations in a patient suspected of having a brain tumor are 100 to 600 c.p.m. more than the highest recorded normal at that particular time interval, then pathological endothelial permeability disturbances must exist at that point. These are indicative of the organic lesion, be it strictly vascular or neoplastic in nature. If cerebral trauma is suspected, whether that be due to an injury, to a recent convulsive seizure, to a recent air-study, or to a recent hematoma, then a repeat study performed ten to fourteen days later will show a decreased radioactive dye concentration, consistent with the regressive vascular disturbances occurring in such lesions two weeks following the more acute episode. On the contrary, if the concentration still remains high, or becomes even higher, then it is suggestive of a progressive vascular endothelial lesion, such as may be secondary to dedifferentiation changes in anaplastic neoplasms or to the effects of large doses of deep x-ray radiation.

Recurrent tumors, regardless of their initial classification, show an increased uptake of radioactive fluorescein because of their increased cellularity, relative anaplasia, and typical hyperplastic, relatively undifferentiated new capillary formations. The latter are not capable of the highly selective permeability function of more differentiated blood vessels.

The radiodye test does not differentiate an acute infection from an anaplastic tumor, since the disturbed capillary permeability in both types of lesion will result in an increased exudation of dye. However, if the infection has gone beyond the stage of "cellulitis," and a well encapsulated abscess results, with central liquefaction necrosis and the absence of new blood vessels, then the radiodye has no deranged blood vessels from which to escape, and normal concentrations are the result. This same explanation is pertinent in differentiating an acute intracranial hemorrhage, with its resultant increased vascularity, perivascular "cuffing," and surrounding edema, from a chronic subdural or intracerebral

hematoma, with its thickened, relatively avascular, highly fibrosed capsule and its large central chocolate cyst. The latter will yield either normal readings or frequently even lower than normal, dependent upon the amount of the cystic contents.

In vitro studies have shown that the cystic tumors do not concentrate radioactive diiodofluorescein in any appreciable amount; therefore, the external measurements over a cystic lesion are usually less than over normal brain. In a few instances, it has been possible to diagnose the presence of a cystic lesion by finding an area of decreased rather than increased radiodye concentration. In the majority of the cases, however, the cysts are not large enough to be picked out or they may be associated with small amounts of neoplastic tissue so that the decreased concentration of the cyst is cancelled by the increased concentration of the tumor.

The differentiation between normality and abnormality is often difficult clinically and microscopically, so that it is to be expected that there will be a certain number of border-line cases in any clinical test. Since the concentration of the radioactive dye depends upon the degree of vascularity and capillary permeability, it is understandable that the relatively slow-growing, avascular, benign lesions will concentrate less of the dye than the vascular, rapidly growing malignant lesions. There have been a number of astrocytomas and oligodendrogliomas which have not been demonstrated by the radioactive diiodofluorescein method. In many of these, it is difficult microscopically to differentiate between normal brain and tumor tissue.

The subdural hematomas and hygromas test out in a manner similar to cysts; that is, they do not concentrate any appreciable amount of the radioactive dye. In the acute stages, however, when there is increased capillary permeability surrounding the subdural hematoma membrane, it is sometimes possible to identify the lesion with the radioisotope tracer study. However, in the majority of lesions, it is impossible to demonstrate an abnormality.

Since the concentration of the radioactive material is dependent upon the amount deposited in the perivascular spaces rather than that present in the circulating blood, it is easy to understand that aneurysms, arteriovenous fistulas, and angiomas do not concentrate increased amounts of the dye; therefore, the method has proved inadequate in diagnosing these lesions. The only exception is an aneurysm that has ruptured and has caused brain damage with resulting increased capillary permeability. This will appear in the test as an organic lesion, and after the bleeding has subsided and the pathological changes have regressed, the radioisotope concentrations will return toward the normal.

Although at times a localized chronic arachnoiditis is accompanied by increased capillary permeability, as shown by an increase in the diiodofluorescein concentration, often the opposite is true; there is a diminished concentration over the site of the lesion as compared to the normal brain. Although it has been possible to diagnose these lesions in a few instances, for the most part, it is impossible.

Metastatic carcinomas and sarcomas give counts in the highest differential range. Next are the glioblastomas, in which the concentration of radiodye appears to be definitely related to the degree of endothelial or adventitial proliferation of the capillaries and to the disturbed permeability of their endothelial cells. For example, the angioproliferative glioblastomas show a lower range of counts per minute difference between the symmetrical areas of the skull than do the angiothrombotic types. Next in the differential range are the vascular and cellular meningiomas, with the more fibrous hyalinized types giving lesser degrees of radiodye concentration. Oligodendrogliomas show the lowest differential count of all the tumors. This appears to coincide directly with the relative microscopic scarcity of capillaries in these tumors. Recurrent gliomas have a much greater uptake of dye, consistent with their increased cellularity and vascularity.

There have been no major untoward reactions with the test. The patients have been comfortable; 6 have had mild paresthesias of the finger tips; 2 have been nauseated, and 1 patient with an intracranial tumor had a seizure on the table for the first time.

With the present procedure the test should not be repeated in doubtful cases until after five days have elapsed, to make certain that all radioactivity has disappeared from any possible focus of poor circulation where at the first test the material may have been pooled and from which it is slowly absorbed. The test is not reliable after acute head injury, after pneumoencephalography, or after a bout of convulsive attacks, because of the temporary disturbance of intracranial vascularity which such conditions are known to produce.

Studies of the distribution and excretion of radioactive diiodofluorescein have been made in human beings, dogs, and rats. The biological half-life in man is two to three days. The highest concentration, after the initial maximum, occurs in the thyroid gland, and the dose of radiation delivered to this tissue is about 8 roentgen equivalents. This is substantially less than that received by patients tested with 50-microcurie doses of radioiodine in studies of thyroid function. The other tissues of the body retain considerably smaller amounts of the radiodye, and in none of the dogs was significant radioactivity detectable seven days after the administration of 25 microcuries per kilogram, or twice the usual dose in man. We believe that there is no significant hazard to the patient from the use of diiodofluorescein in amounts of 1.0 to 1.2 millicuries.

In contradistinction to other neurosurgical diagnostic tests, such as angiography, there have been no contraindications with regard to age, very advanced arteriosclerosis, recent thrombotic or embolic episodes, acute intracranial hemorrhage, hypertension, or cardiac decompensation. Nor has there been any morbidity or mortality from the radiodye tests as there has been in the case of pneumography, particularly ventriculography. As a matter of fact, this test gives better results in the presence of increased intracranial pressure, because the vascular permeability changes are greater.

Of the 536 tests performed upon patients suspected of having an intracranial lesion, 200 have been proved to be accurate by surgical or postmortem verification. The tests upon 272 patients have been placed in a group, the accuracy of which is at the present time undeterminable. Many of these tests have been classed as normal readings and we could include them in the accurate group if we chose to say that the clinical course of the patients thus far justifies the diagnosis of no lesion present. However, since these patients for various reasons were suspected of having an intracranial lesion, we do not believe it to be statistically correct to classify the observations as either accurate or inaccurate. Sixty-four of the tests have been classed as inaccurate. This figure also can be changed if it be taken into consideration that in 23 instances, subdural hematomas, arachnoiditis, or aneurysms were present, since we know that in none of these conditions will the radioactive dye be concentrated consistently. Depending upon which points appear to be most important in any presentation, figures can be shifted from one column to another at will and with good reason. It is far more important to think of this procedure as an addition to our diagnostic abilities than to become involved in mathematical gyrations of convenience.

As it is now performed, the test is time-consuming and expensive but, as with any other new mechanical procedure, improvements in technic and instrumentation will come about in the natural course of events if the method is considered critically. The Geiger-Müller tube now in use undergoes improvements from time to time. Other investigators are improving such devices as the original Selverstone probe counter, the scintillation counter as reported by Kohl, and a new crystal probe counter now in

development in our own laboratories. These are counters to be used at the operating table in an effort to make the surgical removal of the cerebral gliomas more complete, and it is this group of brain tumors which constitute the challenge to neurological surgeons now as they have in the past.

With a continuous change in instruments there undoubtedly will be changes in the isotope chemicals used as the tracer substances. The test as now used should not be thought of as something to replace other, established methods of diagnosis, but rather as a procedure to be used with them, and it should be at all times subject to critical scrutiny. The fact that the test is still short of perfect does not invalidate its potential value. Its promise of usefulness has already been shown, and its possibilities should be exploited and developed to a point where it either stands on its own merits among other standard methods of diagnosis or is discarded as impractical and unreliable.

700 N. Michigan Ave.
Chicago 11, Ill.

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SUMARIO

El Diagnóstico y Localización de las Lesiones Orgánicas del Sistema Nervioso General Mediante el Uso de Diyodofluoresceína Radioactiva

La diyodofluoresceína radioactiva se mostró como valioso auxiliar diagnóstico en los problemas neuroquirúrgicos no sólo por virtud de su notable exactitud en la determinación de la presencia de tumores cerebrales sino también de su relativamente precisa localización focal. La exactitud de los resultados fué comprobada por el estudio quirúrgico o autópsico en 200 de 536 casos; en 272 casos no se podía determinar

la exactitud de los hallazgos en la fecha de la comunicación; en 64 casos se consideró que las pruebas eran inexactas.

Después de la inyección intravenosa del colorante radioactivo, se hicieron numeraciones a lo menos en 32 zonas del cuero cabelludo con un contador externo *ad hoc*. Las numeraciones más significativas se presentan en término de media hora a dos horas de la introducción del medio. Si la concentración observada en cualquier sitio excede del límite superior de lo normal en 100 a 600 numeraciones por minuto, hay que sospechar tumor. Para localizarlo, se hacen entonces comparaciones con la posición simétrica del lado opuesto del cráneo y además con posiciones adyacentes a la zona sospechosa.

Parece que la prueba se basa en gran parte en el grado de vascularidad de una lesión, y más en particular en el endotelio de los capilares terminales.

La prueba no diferencia una infección aguda de un tumor anaplásico; tampoco tiene aplicación al diagnóstico de tumores quísticos o de la mayor parte de los hematomas e higromas subdurales, aneurismas, fístulas arteriovenosas y angiomas. Las metástasis carcinomatosas y sarcomatosas arrojan numeraciones del más alto límite diferencial, viniendo después los glioblastomas, meningiomas vasculares y celulares y oligodendrogliomas.

En los casos dudosos, no se repetirá la prueba sino después de transcurridos cinco días. La misma no resulta fidedigna después de una lesión cefálica aguda, de la neumoencefalografía o de una serie de convulsiones, debido al trastorno temporal de la vascularidad intracraneal que es sabido provocan dichos estados.

DISCUSSION

R. R. Newell, M. D. (San Francisco, Calif.): To discover a small tumor we need a narrow scanning beam. Otherwise the tumor is lost in the background. Even if the collimator cuts the scanning beam to 3 cm. diameter, the volume of brain included is over 100 c.c. A 2-centimeter tumor has a volume of 4 c.c. That's 1/25. Even if the uptake in the tumor is three times more than the brain uptake, the background still gives 8 counts to one for the tumor signal. To get a barely significant detection would require 3×8^2, which is about 200 counts for each setting, and to reduce the statistical error to 10 per cent you'd need 2,000 counts. Obviously you require the utmost in counting efficiency and this means a scintillation counter and an optimal design of the collimator.

Dr. Goldstein (*closing*): Thank you, Dr. Newell. I cannot tell you just exactly what the minimum volume is that we can pick up. We have occasionally been able to pick up tumors of the pituitary gland. I think the answer lies not only in getting a more efficient tube, as was suggested, but also in getting a more specific radioisotope which would be concentrated in a tumor perhaps several hundred times to one instead of just three or four to one as we have now.

Unilateral Calcification of the Basal Ganglia[1]

S. A. TRUFANT, M.D.,[2] and WILLIAM B. SEAMAN, M.D.

SINCE the original roentgen demonstration of symmetrical calcification of the basal ganglia in 1935 by Fritzsche (6) and Kasanin and Crank (7), many cases have been reported. In most of these the calcification has been bilateral and frequently it has been associated with other calcified areas in the cerebrum. Camp (2, 3) mentions two patients with unilateral calcification of the basal ganglia in whom there were no signs or symptoms of brain disease. A case was reported by Rand, Olsen and Courville (9) in which unilateral calcification of the basal ganglia was associated with contralateral extrapyramidal symptoms. It is the purpose of this report to call attention to another example of isolated unilateral opacification of the basal ganglia of sufficient degree to be demonstrated radiologically and associated with signs and symptoms of extrapyramidal disease on the contralateral side of the body.

CASE REPORT

V. G. K., a 33-year-old white married female, was referred to Barnes Hospital from the Out-patient Department because of a drawing sensation in the left hand, leg, and face of fifteen years duration. She had first noticed stiffness of the fingers of the left hand and a rather rigid gait at the age of eighteen. One year later she began to experience drawing sensations in the left forearm, transmitted to the fingers. Although the stiffness persisted, no apparent disability resulted. The patient had always been able to fully flex and extend the fingers of her left hand; she was able to comb her hair and perform other skilled tasks with both hands. Occasionally she had experienced mild numbness in both forearms when lying down in the daytime. During the past two years she had noted some increase in the drawing sensation in the left forearm and hand, most pronounced when she was fatigued. In the past two months there had been a few episodes of left-sided headaches and a tendency for the left corner of the mouth to be drawn laterally.

Fig. 1. Photograph of patient showing characteristic position of left arm and fingers of left hand in rigid extension.

At the age of twenty-eight, the patient had contracted gonorrhea and shortly afterward divorced her husband. During this period of marital strife she began to vomit at frequent intervals, with no relation to food intake and no associated abdominal pain, hematemesis, or melena. She was seen in the Neuropsychiatric Clinic, where extensive interviews led to a diagnosis of conversion hysteria, but no long-term psychiatric treatment was instituted.

On physical examination the patient appeared well developed and well nourished. The fingers of the left hand were held stiffly extended (Fig. 1); they flexed easily and completely, both actively and passively, but there was some difficulty in abduction. Slight cog-wheel rigidity was noted at the left elbow. There was mild dysdiadokokinesis of the left hand but no dysmetria or loss of proprioception.

[1] From the Departments of Neuropsychiatry and Radiology, Washington University School of Medicine, St. Louis, Mo. Accepted for publication in January 1952.

[2] Now in the Department of Neurology, Cincinnati General Hospital.

Fig. 2. Detailed view of the lateral skull roentgenogram. The shape of the calcific deposit suggests its location in the basal ganglia. The parallel striations suggest that the calcium might be deposited in relation to blood vessels.

On walking, the left knee was somewhat rigid, but there was a full range of passive and active motion of the joint. The deep reflexes were normal. The remainder of the physical and neurological examination was non-contributory.

Urinalysis and hematological findings were within normal limits. The Kahn test was negative. A lumbar puncture disclosed clear cerebrospinal fluid under an initial pressure of 190 mm. of water, containing eight cells after acidification. The total protein was 61 mg. per cent. The blood and spinal fluid Wassermann reactions were negative. The total blood protein, serum calcium, and serum phosphorus were normal. An electroencephalogram showed no significant abnormality.

Roentgen examination of the chest and hands was not remarkable. Examination of the skull revealed no significant abnormalities of the bony calvarium. In the lateral view, a roughly oval, circumscribed area of calcific density was noted above the sella turcica and anterior to the site of the pineal body. In the frontal projection it was seen that this calcification was wholly within the right cerebral hemisphere (Figs. 2 and 3). The shape and position suggested calcification of the basal ganglia on the right side. Close inspection disclosed vertical, parallel striations suggesting deposition of calcium in relation to vessels. The pineal body was not calcified and no other intracranial calcifications were observed. Roentgenograms were also taken of the patient's sister and her two daughters, but no evidence of intracranial calcifications or other abnormalities was obtained.

Psychological examination, interrupted by frequent outbursts of tears and refusal by the patient to go on with the tests, revealed signs of intellectual deterioration and indicated that over and above the suggested neurological involvement there was a psychological disturbance which seemed to stem from great difficulty in interpersonal relationships as well as an immature and poorly integrated emotional development.

A psychiatric consultant diagnosed a severe lifelong psychoneurosis, and it was considered quite likely that psychogenic stress exaggerated the organic extrapyramidal lesions. Since there was no significant disability from the rigidity of the left

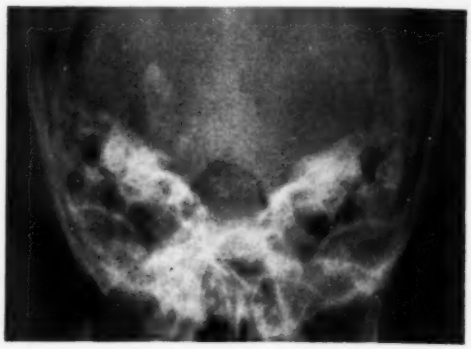

Fig. 3. Detailed view of the calcification as seen in the Towne projection.

arm and hand, the patient was given reassurance only and was followed by the neuropsychiatrists. On one occasion, during a sodium amytal interview, marked relaxation of the left hand and forearm was noted, but the spasticity returned, and at the time of discharge there was no evident increase in relaxation of the hand or forearm. It was also noted that when the patient was excited, cog-wheel rigidity was demonstrable at all joints of the left forearm.

Comment: This case closely parallels the one reported by Rand, Olsen, and Courville. The degree of extrapyramidal involvement evident in the contralateral extremities is perhaps not so marked, but its chronic slow progression without impairment of the ipsilateral extremities would seem to be a significant pattern. From the evidence at hand there is no clue to the etiology of the process. The patient's sister and two daughters were examined because of the occasional familial occurrence of this condition. Fritzsche described these changes in three siblings and Levy (8) has made similar observations in several members of one family. The normal blood calcium and phosphorus rule out the possibility of hypoparathyroidism, as does the absence of any of the signs

and symptoms of that condition. The possibility of a calcified tumor is unlikely in view of the duration of the symptoms and normal cerebrospinal fluid pressure and protein content.

DISCUSSION

Calcification of the basal ganglia has long been known as a pathologic entity, but Camp and his co-workers emphasized that the condition is also a roentgenographic entity. A wide variety of diseases may be responsible for intracranial calcification. These can be grouped under the general categories of tumor, vascular lesions, inflammations, parasitic diseases, degenerative conditions, tuberous sclerosis, and parathyroid insufficiency. In an extensive review of the literature, from which they collected over a hundred cases, Eaton, Camp and Love (5) found calcified basal ganglia to occur in patients with a history of encephalitis, tuberous sclerosis, toxoplasmosis and mental deficiency dating from birth, and hypoparathyroidism. In all except the last two conditions there are calcium deposits elsewhere in the cerebrum. The calcifications seen in hypoparathyroidism and mental deficiency are roentgenologically indistinguishable.

It is generally believed that hyaline degeneration of the vessel walls precedes the deposition of calcium. This has been correlated by Alexander and Woodhall (1) with the breakdown of lecithin and the release of phosphoric acid thus made available for the precipitation of calcium. The localization of the process to the basal ganglia, especially the globus pallidus, has been linked to its high metabolic activity and greater sensitivity to anoxemia. It is possible that a varying part of the density seen on the roentgenogram may represent iron instead of calcium. Strassmann (10) stated that the presence of iron in and around blood vessel walls was a common finding in the globus pallidus in many conditions and considered it a manifestation of an involutional process. Craig (4) has shown in one case of Sturge-Weber's disease that the curvilinear densities seen on the roentgenogram were due in large part to deposits of iron.

The differential diagnosis includes all of the conditions that fall under the categories mentioned above causing intracranial calcification. Most of these can be differentiated by the presence of calcific deposits elsewhere in the cerebrum. Calcification of the choroid plexus is usually located at the genu of the lateral ventricle and thus would be located more posteriorly. Neoplasia is always to be considered but can usually be excluded by a long duration of symptoms and absence of cerebrospinal fluid changes.

SUMMARY

A case of unilateral calcification of the basal ganglia of the brain, demonstrated radiologically, and associated with contralateral manifestations of extra-pyramidal disease has been described.

510 S. Kingshighway Blvd.
St. Louis 10, Mo.

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SUMARIO

Calcificación Unilateral de los Ganglios Basales

El caso descrito es de calcificación unilateral de los ganglios basales del cerebro, observada radiológicamente, y asociada a manifestaciones contralaterales de enfermedad extrapiramidal.

El enfermo comunicó una historia larga de rigidez y de sensación de tirantez en el brazo y antebrazo derechos, con reciente aparición de cefalalgia del lado izquierdo y tendencia de la comisura izquierda de la boca a virarse de lado. Las radiografías del cráneo revelaron una zona de calcificación en el lado derecho que abarcaba los ganglios basales.

En este caso, había, por encima de la afección neurológica, un trastorno psicológico que podía, según parecía, agudizar la lesión extrapiramidal orgánica.

Loss of a Radon Seed in a Patient

A Case Report[1]

MAURICE M. MANALAN, M.D., and WILLIAM J. LITTLE, M.D.
Indianapolis, Ind.

THE PROBLEM OF lost radium needles or radon seeds in the practice of radiology is not uncommon (1). This report will serve to call attention to an unusual location in which such a "lost" needle or seed may be discovered and to indicate that it has not necessarily found its way into a garbage pail, sewer, crack in the floor, or city dump, or been stolen. There are many reports of such losses, but few cases are on record in which the radioactive material was "lost" in the patient. The report also proves the fallibility of instruments and the need for care and intelligence in their use

CASE REPORT

A 51-year-old white male with a diagnosis of squamous-cell carcinoma of the right tonsil, with cervical node metastases, received x-ray therapy to the primary lesion and the node-bearing area in the right side of the neck. All but one node in the region of the right submaxillary gland, approximately 0.5 cm. below the skin surface, regressed. Radon seed implantation was decided upon, and with the patient in a semireclining position eight seeds were inserted by direct puncture. Upon insertion of one of the seeds, bleeding from the puncture wound was quite free, requiring compression for approximately one minute. No unusual bleeding was noted when the other seeds were introduced. Approximately five minutes after the seeds had been implanted, a roentgenogram of the neck was taken to determine their position. It was noted that only seven seeds were present, and a search for the missing seed was initiated.

A physicist was called to survey the operating room, and a laboratory type monitor was used without yielding any trace of the lost seed. Since we knew that it might have been aspirated or swallowed, films of the chest and abdomen were made, but failed to reveal the seed.

The patient was then checked using a survey meter of the ionization chamber type, and all personnel in the immediate vicinity were surveyed without giving any clue. During the time of this survey one of the x-ray technicians obtained a film of the pelvis of the patient to use in an examination for the registry. In this roentgenogram the seed was seen in the region of the left femoral triangle. The patient was again checked with the survey meter and a reading was obtained in the femoral area five times as great as over any other part of the body exclusive of the implanted area in the neck. As of this date, two months later, no ill effects have been observed from the seed, and its position is unchanged.

DISCUSSION

There are several ways by which a radium needle or radon seed may become "lost" in the patient. The implanted tumor may melt down rapidly and the seeds or needles may slip out of position (4). This possibility is of special significance about the face and neck since small foreign bodies can be aspirated and may produce lung abscesses. Radium needles have entered veins by a process of slow necrosis. Swallowed foreign bodies can reach the cardiovascular system by passing through the piriform fossa and entering the jugular vein, by passing through the wall of the lower third of the esophagus and into the heart, or by penetrating the duodenal wall and into the inferior vena cava (2). To these, we believe, should be added the possibility of accidental insertion of a radon seed directly into an artery or vein.

When a radon seed enters a blood vessel, it will usually migrate as an embolus, but it may move with gravity against the flow of the blood stream (2).

In experiments on dogs, Achard and

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Fig. 1. Anteroposterior view of the pelvis two hours after implantation of the radon seed. The seed is clearly shown in the left femoral area.
Fig. 2. Lateral view of the hip showing the radon seed in the left femoral triangle.

Binet showed that the migration of lead pellets introduced into a peripheral vein is influenced by gravity, velocity of the flow of the blood stream, the weight of the pellets, and their size and shape (5). If the seed becomes impacted in a peripheral artery, gangrene may result. If it enters a vein it usually reaches the heart, stopping there or passing through the right side to lodge in a branch of the pulmonary artery. This migration may be intermittent, with the seed lodging for varying lengths of time in different parts of the cardiovascular system along its route to a final resting place. Again, the seed may by-pass the heart when it enters a vein and, due to the effect of gravity, pass into the inferior vena cava. When such is the case, it usually lodges in the internal iliac or femoral vein (6).

Lambert Rogers reports a case in which a radium needle that had been implanted in a mass of nodes in the posterior triangle of the neck was later removed from the right pulmonary artery (3). Barrett (6), in his excellent discussion of foreign bodies in the cardiovascular system, includes a case of a woman in whom small (1 mg.) radium needles were implanted in a primary lesion of the face and also in a mass of malignant supraclavicular nodes. Two of the needles were subsequently found to have migrated from the site of implantation. One was found near the body of the seventh cervical vertebra; the other was seen by x-ray study to lie in the pelvis outside and behind the bowel. At autopsy the latter needle was found in the right internal iliac vein. It was concluded that it had entered one of the great cervical veins, dropped down the superior vena cava, through the right auricle, into the inferior vena cava, and on down to the internal iliac vein.

In our own case we are of the opinion that the "lost" seed was injected directly into a deep vein in the neck and migrated as a retrograde embolus into the superior vena cava, by-passing the heart, into the inferior vena cava. It subsequently became lodged in one of the first valve stations in the left femoral vein. This is in accordance with the experimental work of Achard and Binet, cited above.

Were it not for the fact that a film of the pelvis was obtained by chance, it is possible that we might never have determined what happened to the "lost" seed. Until we knew the exact location of the seed, the survey meter failed to aid us.

CONCLUSIONS

1. Radon seeds, when introduced into a vein, may act as retrograde emboli and, if they enter the inferior vena cava, will probably lodge in an internal iliac or femoral vein. A case of this type is reported.

2. Many instruments are available to find lost radium, but in detecting a low-content seed or needle deep in a patient, the survey meter must spot check all areas of the body with particular care, or the radium may be passed over without a significant reading.

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2601 Cold Spring Rd.
Indianapolis, Ind.

SUMARIO

Pérdida de una Semilla de Radón en un Enfermo: Historia Clínica

En el caso descrito, se descubrió en un enfermo una semilla de radón perdida. La misma era una de ocho simientes implantadas en un ganglio cervical que persistió después de la roentgenoterapia por carcinoma de la amígdala.

Parece que la semilla perdida fué inyectada directamente en una vena profunda del cuello y migró, en forma de émbolo retrógrado, a la cava superior y, desviándose del corazón, a la cava inferior y alojándose por fin en la vena femoral izquierda. Una inspección del sujeto con un medidor de los de yonización no reveló la semilla, que se descubrió por casualidad en una radiografía tomada con otro fin. Después del descubrimiento, otra inspección con el medidor mostró en el sitio de la semilla una lectura cinco veces mayor que la de ninguna otra parte del cuerpo, excepto por la zona implantada en el cuello.

Circumcaval Ureter[1]

WYLIE H. MULLEN, JR., M.D., and WILLIAM J. ENGEL, M.D.
Cleveland, Ohio

THIS PAPER DEALS with an interesting anomaly of the inferior vena cava which has been variously called postcaval ureter, retrocaval ureter, circumcaval ureter, and preureteric vena cava. We prefer the designation circumcaval ureter, since it best describes the anomaly and since one of us (W.J.E.) has observed a case in which the ureter occupied a position posterior to the inferior vena cava yet reappeared laterally without circumscribing that vessel. Although reports of 55 cases of this anomaly were found (1–47), none of these has appeared in a roentgenologic journal. Because the preoperative diagnosis can be made only by roentgenology, a recently proved case of ours prompted a review of the literature with special attention to the x-ray studies.

Of the 55 cases previously reported, 21 were discovered in dissecting room cadavers or at autopsy and 34 at surgery; 1 was diagnosed roentgenographically but the patient was not operated upon (47). The first correct preoperative diagnosis was made by Harrill (22) in 1940. Since then, 16 cases (Goyanna *et al.*, 29; Greene and Kearns, 30; Creevy, 34; Corbus, 35; Schwartz and Irey, 36; Anderson and Hynes, 37; Lich and Grant, 38; Shearer, 39; Lyter and Meyer, 40; Olson and Austen, 41; Sabatini and Wessler, 42; Beard and Goodyear, 43; Jacobson, 44; Duff, 45; Heslin and Mamonas, 47), in addition to our case, have been diagnosed correctly by roentgen studies. In Table I are listed the reported cases with pertinent information concerning them.

CASE REPORT

A 33-year-old white man was first seen at the Cleveland Clinic on Dec. 7, 1948, complaining of pain in the right loin, radiating at times into the right lower quadrant. The pain had been present intermittently for eleven years. It was somewhat relieved by physical activity or by lying on either side. The patient had never had chills or fever but had experienced occasional episodes of frequency of urination and dysuria, accompanied by "cloudy urine." Gross hematuria had occurred on one day eleven years previously. For the past ten years cystoscopic examination with ureteral dilatation had been done at frequent intervals. Seven years previously the patient had undergone an appendectomy, without relief, for right lower quadrant pain. The past history and family history were non-contributory. Physical examination was negative except that the right kidney was questionably palpable. Urinalysis revealed no abnormal findings. Multiple urinary cultures were negative.

Intravenous pyelography on Dec. 8, 1948, disclosed a normal left kidney and ureter. On the right there were severe hydronephrosis and hydroureterosis of the upper ureter. The pelvis and upper portion of the ureter were somewhat redundant and assumed an S-shaped configuration. At the end of one hour there was considerable retention of dye in the dilated right pelvis and ureter. The most distal portion of the ureter seen on the pyelogram curved noticeably in a medial direction, almost to the midline at L-4. The distal ureter was not visualized (Fig. 1). These findings were interpreted as indicative of right hydronephrosis and hydroureterosis, probably due to stricture of the right ureter.

On Jan. 17, 1949, cystoscopy and right ureteropyelography were performed. The bladder was found to be normal except for changes suggesting a mild diffuse low-grade cystitis. A No. 8 Garceau catheter could be passed up the right ureter for a distance of 8 cm. A retrograde pyelogram (Fig. 2) showed pronounced right hydronephrosis and right hydroureter. The upper ureter was S-shaped with the most distal portion passing medially to the midline. The distal two-thirds of the ureter appeared normal. Oblique films showed the ureter to lie close to the vertebral bodies.

On the basis of these pyelograms, a diagnosis was made of right hydronephrosis and hydroureter, probably due to right circumcaval ureter. On Jan. 19, the patient was operated on by Doctors W. J. Engel and C. C. Higgins. Upon opening Gerota's fascia, a greatly dilated loop of ureter was encountered. The ureter could be followed medially behind and around the vena cava, appearing on the

[1] From the Cleveland Clinic and the Frank E. Bunts Educational Institute, Cleveland, Ohio. Accepted for publication in January 1952

medial aspect of that structure and from there pursuing a normal course into the pelvis. The ureter was freed by dissection from above and below, was divided at a point where its diameter was 2 cm., and replaced in normal position. It was apparent, however, that excess ureter was present and approximately 3 inches was excised. At the point of division below the renal vessel, the diameter of the cut

Fig. 1. Intravenous pyelogram taken at one hour, showing marked hydronephrosis and hydroureter, "S"-shaped configuration of the upper ureter, and medial deviation of its most distally visualized portion.

segment approximated the diameter of the end of the distal ureter. The two ends were anastomosed with sutures so placed as to evert the mucosa. A McIver type of nephrostomy tube was introduced into the renal pelvis approximately 1 inch above the line of anastomosis, the distal end being threaded down into the ureter. A cigarette drain was placed down to the line of anastomosis and the wound was closed.

Pyelograms, one week after operation, did not visualize the anastomotic area well, but no dye was seen in the lower ureter. A urogram, two weeks postoperatively, revealed good function but some retention at one hour. The lower ureter was not visualized. The tube was removed on the twelfth postoperative day.

The patient returned on March 11, 1949, complaining of dull right flank pain. A urogram revealed a calculus in the right ureter and increased dilatation. On March 14, cystoscopy revealed mild cystitis. A No. 8 Garceau catheter passed 19 cm. but no further. No. 5 and No. 6 cork-screw catheters could be passed only to a distance of 20 cm. The No. 8 catheter was reintroduced, and pyelography revealed a blocked ureter with only a trickle of dye going through. The patient was reexplored on March 16, and the upper ureter was found to end in a blind pouch. Nephrectomy was performed. It was thought that the breakdown of the anastomosis was probably due to insufficient blood supply. The postoperative course was complicated by wound hematoma and intercostal neuralgia. When last seen, on July 9, 1951, the patient was well and symptom-free.

Fig. 2. Retrograde pyeloureterogram showing the marked medial deviation of the ureter beyond the pedicle of L-4 and the redundant hydroureter forming a roughly "S"-shaped configuration.

EMBRYOLOGY

The congenital anomaly responsible for circumcaval ureter is actually primary in the vascular system rather than in the urinary system. For detailed studies of the embryology of the vena cava and

TABLE I: REPORTED CASES OF CIRCUMCAVAL URETER

Date	Author	Age	Sex	How Proved	Type	Hydro neph-rosis	"S" Shape	Study X-Ray	Preop. Diag-nosis	Treatment
1893	Hochstetter (1)	Few weeks	M	P.M.	Rt.	Absent	No	...	...	.....
1905	Gladstone (2)	Stillborn	M	P.M.	Bil.*	Absent	No	...	...	.....
1909	Kolisko (3)	55	M	P.M.	Rt.	Yes	Yes	...	...	.....
1911	Gladstone (4)	84	M	P.M.	Rt.	Yes	Yes	...	...	.....
1927	Jacobson (5)	72	M	P.M.	Rt.	Yes	Yes	...	...	.....
		1	M	P.M.	Rt.	Absent	No	...	...	.....
1927	Wicke (6)	58	M	P.M.	D.v.c.r.†	?	No	...	...	.....
1928	Kengyel (7)	57	F	P.M.	Rt.	Yes	No	...	...	.....
1928	von Gierke (8)	16	M	P.M.	D.v.c.r.†	Yes	No	...	...	.....
1931	Skamnakis (9)	50	M	P.M.	Rt.	Yes	Yes	...	...	.....
1934	Kimbrough (10)	20	M	Op.	Rt.	Yes	Yes	Yes	No	Plastic: successful
1935	Rotter (11)	49	M	Op.	D.v.c.r.†	Yes	Yes	No	No	Removal of stone
		?	M	P.M.	Bil.v.c.‡	Absent	No	...	...	.....
1935	Randall and Campbell (12)	25	F	Op.	Rt.	Yes	Yes	Yes	No	Nephrectomy
		55	F	Op.	Rt.	Yes	Yes	Yes	No	Nephrectomy
1936	Shih (13)	44	M	Op.	Rt.	Yes	Yes	Yes	No	Nephrectomy
1936	Derbes and Dial (14)	Adult	?	P.M.	Rt.	Yes	Yes	Yes (P.M.)	...	.....
		Adult	?	P.M.	Rt.	Yes	?	No	...	.....
1936	Uebelhör (15)	34	F	Op.	D.v.c.r.†	Yes	Yes	Yes	No	Plastic: successful
1937	Wren (16)	Adult	M	P.M.	Rt.	Absent	No	No	...	.....
1937	Derbes and LaNasa (17)	42	F	Op.	D.v.c.r.†	Yes	Yes	Yes	No	Nephrectomy
1937	Adachi (18)	42	M	P.M.	Bil.v.c.‡	?	No	No	...	.....
		40	F	P.M.	Rt.	Absent	No	...	...	.....
1938	May (19)	17	M	Op.	Rt.	Yes	Yes	Yes	No	Plastic: successful
1939	Antopol and Yelin (20)	72	F	P.M.	Rt.	Yes	No	...	...	.....
1939	Mejias Palazzi, *et al.* (21)	Adult	M	P.M.	Rt.	Absent	No	...	...	.....
1940	Harrill (22)	46	M	Op.	Bil.v.c.‡	Yes	Yes	Yes	Yes	Plastic: successful
1940	Pick and Anson (23)	44	M	P.M.	Rt.	Absent	No	...	...	.....
1940	Harbach (24)	20	M	Op.	Rt.	Yes	Yes	Yes	No	Nephrectomy
1940	DeCarlo (25)	60	M	P.M.	Rt.	Absent	No	No	...	.....
1943	Gruenwald and Surks (26)	Adult	M	P.M.	Bil.v.c., D.v.c.r.‡	Absent	No	No	...	.....
1944	Wilson and Herslich (27)	21	M	Op.	Rt.	Yes	Yes	Yes	No	Nephrectomy
1946	Lowsley (28)	44	M	Op.	Rt.	Yes	Yes	Yes	No	Plastic. Stricture later
1946	Goyanna, *et al.* (29)	33	M	Op.	Rt.	Yes	Yes	Yes	Yes	Plastic
1946	Greene and Kearns (30)	29	M	Op.	Rt.	Yes	Yes	Yes	Yes	Plastic: successful
1946	Nourse and Moody (31)	21	M	Op.	Rt.	Yes	Yes	Yes	No	Plastic. Nephrectomy for stone later
1947	Young (32)	24	F	Op.	Rt.	Yes	Yes	Yes	No	Removal of calculus. Retrograde pyelography, postop.
1948	McElhinney and Dorsey (33)	20	M	Op.	Rt.	Yes	Yes	Yes	No	Plastic: successful
1948	Creevy (34)	12	F	Op.	Rt.	Yes	Yes	Yes	Yes	Plastic: successful
1948	Corbus (35)	34	M	Op.	Bil.v.c.‡	Yes	Yes	Yes	Yes	Nephrectomy
1949	Schwartz and Irey (36)	20	M	Op.	Rt.	Ureter only	No	Yes	Yes	Nephrectomy
1949	Anderson and Hynes (37)	10	F	Op.	Rt.	Yes	No	Yes	Yes	Plastic: successful
1949	Lich and Grant (38)	44	M	Op.	Rt.	Yes	Yes	Yes	Yes	Nephrectomy
1949	Shearer (39)	24	F	Op.	Rt.	Yes	Yes	Yes	Yes	Plastic: successful
1949	Lyter and Meyer (40)	18	M	Op.	Rt.	Yes	No	Yes	Yes	Plastic. Second operation for torsion

TABLE I (*Continued*)

Date	Author	Age	Sex	How Proved	Type	Hydro neph-rosis	"S" Shape	Study X-Ray	Preop. Diag-nosis	Treatment
1950	Olson and Austen (41)	26	M	Op.	Rt.	Yes	Yes	Yes	Yes	Plastic: successful
1950	Sabatini and Wessler (42)	63	M	Op.	Rt.	Yes	Yes	Yes	Yes	Nephrectomy
1950	Beard and Goodyear (43)	31	M	Op.	Rt.	Yes	No	Yes	Yes	Nephrectomy
1950	Jacobson (44)	45	M	Op.	Rt.	Yes	Yes	Yes	Yes	Plastic: successful
1950	Duff (45)	51	M	Op.	Rt.	Absent	Yes	Yes	Yes	Nephrectomy
1951	Schmidt, *et al.* (46)	29	M	Op.	Rt.	Yes	Yes	Yes	No	Plastic: successful
1951	Heslin and Mamonas (47)	40	F	Op.	Rt.	Yes	Yes	Yes	No	Nephrectomy
		39	M	X-ray	Rt.	Yes	Yes	Yes	Yes	.....
		37	M	Op.	Rt.	Yes	Yes	Yes	Yes	Plastic: successful
		53	F	Op.	Rt.	Yes	Yes	Yes	Yes	Nephrectomy
1951	Mullen and Engel	33	M	Op.	Rt.	Yes	Yes	Yes	Yes	Plastic. Nephrec-tomy later for stricture and stone

* Bilateral vena cava with bilateral circumcaval ureters.
† Double right vena cava with right circumcaval ureter.
‡ Bilateral vena cava with right circumcaval ureter.

anomalies in its development the reader is referred to the comprehensive works of McClure and Butler (48), Randall and Campbell (12), and Pick and Anson (23). During early fetal life, as the kidney makes its ascent to its permanent anatomic position, it passes upward through a ring of primitive venous channels called the periureteric ring. At this phase, the primitive abdominal venous system is composed of three sets of bilateral venous channels. These paired veins are the postcardinal (most lateral and ventral), the supracardinal (most dorsal), and the subcardinal (most medial). The periureteric ring is completed by the anastomosis of these three vessels. Ventrally, it consists of the lumbar division of the postcardinal and subcardiopostcardinal anastomosis. Dorsally, the ring is made up by the lumbar division of the supracardinal vein and the subcardinal-supracardinal anastomosis. In the normal course of events, the ventral portion of the ring atrophies and the persistent dorsal portion becomes the adult vena cava. The normal ureter thus lies anterior and lateral to the vena cava. The paired left vessels all atrophy after the left renal vascular pattern has been completed.

The failure of this normal sequence may lead to an anomalous circumcaval position of the ureter on one or both sides. There are at least five recognized variations of this anomaly:

I. The most common type has presumably occurred in 45 of the 56 cases thus far reported (including our own). It results when ventral instead of dorsal limbs persist or when a dorsal limb fails to develop.

II. The occurrence of the preceding event bilaterally results in bilateral circumcaval ureter. This has been seen in only one instance, reported by Gladstone (2) in an acardiac fetus.

III. Persistence of both limbs on the right gives a double right vena cava with the ureter between the two vessels. Four cases have been seen (Wicke, 6; von Gierke, 8; Rotter, 11; Derbes and La-Nasa, 17).[3]

IV. Persistence of the ventral limb on the right and the dorsal limb on the

[3] For footnote, see next page.

left results in bilateral vena cava with a right circumcaval ureter. Five cases have been reported (Rotter, 11; Uebelhör, 15; Adachi, 18; Harrill, 22; Corbus, 35).[3]

V. Persistence of both limbs on the right and a dorsal limb on the left gives bilateral vena cavas with double right vena cava. This has been reported once (Gruenwald and Surks, 26). In that instance, the left ureter was normal while the right circumscribed the anterolateral of the two right vena cavas.

In many of the operative cases, the exact vascular pattern has not been determined, especially with regard to the presence of single bilateral vena cava, since the left side has been unexplored. The presence of the left vessel can be inferred, however, if the right vena cava is abnormally small or only the right iliac enters this vessel (the left iliac presumably emptying into a left vena cava, which in turn may enter the left renal).

CLINICAL CONSIDERATION

Of 54 cases of circumcaval ureter for which the sex is known, 13 have been found in women (ratio of 3 to 1). Early investigators felt that this difference was accountable by the greater number of males examined in the dissection room and on the autopsy table. However, since 25 of the 35 cases discovered clinically have been in men (a ratio of 2 1/2 to 1) the difference is probably authentic. The reason for it is not known.

The clinical discovery of the condition is usually not made until adulthood. Only 4 of 35 patients observed clinically were under twenty years of age.

Symptoms may be mild or entirely absent, as in the early, presumably asymptomatic cases discovered at autopsy and the asymptomatic case reported by Jacobson (44) and observed during the routine investigation of hypertension in a forty-five-year-old man. The symptoms have varied in duration from a few days to a period of thirty years, as in the case of Sabatini and Wessler (42). Most frequently seen are symptoms of right obstructive uropathy with or without superimposed evidence of secondary urinary sepsis or stones. Flank pain, with or without radiation, nausea, vomiting, dysuria, nocturia, chills, fever, and vague gastrointestinal disturbances may be encountered. Hematuria, either gross or microscopic, has been a frequent finding. Thirty-four of 35 patients seen clinically have had some degree of hydronephrosis and/or hydroureter. This dilatation is always proximal to the portion of the ureter circumscribing the vena cava. The obstruction would, in most cases, appear to be due to pressure between the vena cava and aorta or vertebrae; however, stricture, fixing lumbar veins, renal ptosis, and presence of a venous crotch may be factors in some cases.

Physical examination usually reveals little except for right flank tenderness. Laboratory studies are for the most part negative except for red and white cells in the urine and, in cases with associated infection, leukocytosis, fever, and positive urinary cultures.

X-RAY FINDINGS

It is only by means of intravenous or retrograde pyelography that a diagnosis of circumcaval ureter can be reached. In 36 cases, x-ray studies have been made (the 34 operative cases, the one diagnosed by Heslin and Mamonas (47) but treated conservatively, and the case of Derbes and Dial (14), in which a pyelogram was obtained postmortem after discovery of the

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[3] Footnote to page 531

Although in their article, Derbes and LaNasa do not mention the type of anomaly present, a footnote on page 232 of the article by Derbes and Dial (14) states: "As this article was being prepared, Dr. LaNasa called our attention to another case in which the right ureter passed behind a large vein to right of midline. A nephrectomy was performed from a posterior approach and the ureter could not be traced further than the medial side of this vein. It would appear, therefore, that this is a case of double vena cava with the ureter passing behind the persistent posterior cardinal. This case will subsequently be reported by him."

[3] Corbus did not state the type of anomaly present in his case but since he noted in his operative report that the preureteric vena cava was only 40 to 50 per cent of normal size, it is likely that his patient had another vena cava on the left.

condition). The most constant finding has been displacement of the ureter toward the midline at the L-3 or L-4 level. This has been seen in all 36 cases examined roentgenologically and in most of the cases with pathological reports accompanied by drawings or sketches. In most instances the most medially deviated portion of the ureter reached the spinous processes, and in no case of the most common type (right circumcaval ureter with single right vena cava) did it lie more laterally than the medial margin of the right lumbar pedicle. In the case of Derbes and LaNasa (double right vena cava), the ureter was only as far medial as the transverse process (17). This undoubtedly is the situation when two right vena cavas are present and only the more lateral one is circumscribed. In the other cases of double right vena cava x-ray studies have not been done but anatomic description would substantiate this fact. In the case of bilateral vena cava, the medial deviation has been past the pedicles, as would be expected, since, except for its smaller size, the right vena cava resembles the normal one. From the drawings illustrating the case reported by Gruenwald and Surks (26), in which a double right and a left vena cava were present, the ureter was somewhat less medially displaced than in the more common type.

The second most common finding is hydronephrosis and hydroureter. This has been present in every one of the clinical cases except that of Duff (45). The case reported by Schwartz and Irey (36) showed hydroureterosis only. In all cases the dilatation has been in the proximal third of the ureter, which has been of normal size below its circumvention of the vena cava. In addition, hydronephrosis and hydroureter were present in 9 of the 21 postmortem cases; the status of the ureter and pelvis was not stated in 2 cases; 3 cases occurred in infants, and 2 patients had circumcaval ureters of type other than Type I. In only 5 adults with right single circumcaval ureter was obstructive uropathy absent.

In cases where the obstruction is most evident and hydronephrosis is pronounced, the upper ureter and pelvis elongate, become redundant, and form the falciform or S-shaped curve which has been described by other authors. This S-shaped curve was present in 31 of the 36 clinical cases and in at least 5 seen postmortem; 6 of the cases in which it was not found at necropsy showed the rarer anomalies. Only 10 adults with right single vena cava did not demonstrate this feature.

As first pointed out by Randall and Campbell (12), oblique or lateral pyelograms will show that the ureter remains close to the spine, instead of falling away anteriorly as it does normally, when not held by the vena cava. While this has proved to be true in the most common type of anomaly, it would not necessarily be so when a double vena cava was present on the right, since the ureter passes between the two and is separated from the spine by the posterior branch.

In cases where stereo or biplane roentgenograms are made, an arcuate or spiral configuration of the ureter is demonstrated, which corresponds to the size of the encircled vena cava.

In 2 cases reported by Beard and Goodyear (43) and Duff (45) venograms were obtained with right ureteral catheters in place, showing the vena cava to lie just lateral to the most medially deviated portion of the ureter.

Although both intravenous and retrograde studies have been made, the latter are the more satisfactory. If severe renal destruction has occurred, the intravenous pyelogram may show poor function or absence of function on the right side. Intravenous pyelograms will fail to visualize the right lower ureter and will show retention of dye above the obstruction on the one-hour film.[4]

[4] W. J. E. has seen the roentgenograms on 1 other patient with circumcaval ureter and W. H. M. on 4 additional patients, made in other hospitals and not available for inclusion in this paper. All the patients were adults, 3 males and 2 females. All showed typical findings of medial deviation, hydronephrosis and hydroureter, and "S"-shaped deformity.

DIAGNOSIS

As stated above, diagnosis can be made only by roentgenology. The typical findings in the various types may be summarized as follows:

Type I: Right circumcaval ureter with single right vena cava:

(1) Medial deviation of the ureter on the antero-posterior film to a location beyond the pedicles and probably to the spinous processes at the L-3 or L-4 level.

(2) On lateral or oblique views, failure of the ureter to fall away anteriorly from the spine. Instead, it hugs the vertebral bodies.

(3) Hydronephrosis and hydroureter of the upper third of the ureter.

(4) S-shaped, falciform or sickle-shaped upper ureter and pelvis.

(5) No visualization of distal ureter on intravenous urograms.

(6) Arcuate or spiral curve of the midline portion of the ureter corresponding to the size of the vena cava on the stereoroentgenogram or roentgenograms made in two planes.

(7) Passage of dye in the inferior vena cava through this sharp ureteral arc, demonstrable on venograms with a catheter in place.

Type II: Double right vena cava with ureter passing between the two vena cavas:

(1) Medial deviation of the ureter but only to the transverse processes or to the right lumbar pedicles.

(2) Moderate or no hydronephrosis and hydroureter.

(3) Less tendency to the presence of an S-shaped curve.

(4) Some displacement of the ureter away from spine in oblique or lateral pyelograms.

(5) Somewhat smaller vascular defect in the anteroposterior and oblique ureteropyelogram due to the smaller size of the right anterolateral vena cava when two are present.

(6) Smaller, more lateral vena cava demonstrated by venograms and possible visualization of both vena cavas.

Type III: Bilateral vena cava with right circumcaval ureter:

(1) Same as in Type I except if venography is done. If the left femoral is injected, only the left vena cava will be demonstrated; if both femorals are injected bilateral vena cavas will be revealed. The slightly more lateral position of the vena cavas when they are present bilaterally may not be perceptible on the anteroposterior or oblique pyelograms.

Type IV: Bilateral vena cava with bilateral circumcaval ureter:

(1) Bilateral picture as described for Type I.

Type V: Bilateral vena cava with double component on right:

(1) Same as Type II except that bilateral venograms may show a left vena cava and double component on the right.

DIFFERENTIAL DIAGNOSIS

The differentiation of circumcaval ureter from all other obstructive uropathies can usually be made by the absence of medial deviation of the ureter and the difficulty which is encountered in passing a catheter past an actual mechanical obstruction.

Deviation of the ureter by neoplastic masses usually produces a long smooth curve in the deviated segment and shows no hydronephrosis or hydroureter.

Obstruction at the ureteropelvic junction by aberrant arteries, stricture, or abnormal insertion of the ureter, produces hydronephrosis, but the ureter is not dilated and does not swing toward the midline.

We know of only two conditions which might present an actual problem in differentiation. The first is the defect produced in the ureter by the ovarian vessels (the only vein normally passing anterior to the upper ureter). Figures 3, 4, and 5 show such a case in a 34-year-old woman with no urinary symptoms, who was given a urologic examination because of unexplained mild edema of both legs. She had had an episode of leg swelling five years previously which had gradually subsided and it was believed that this may

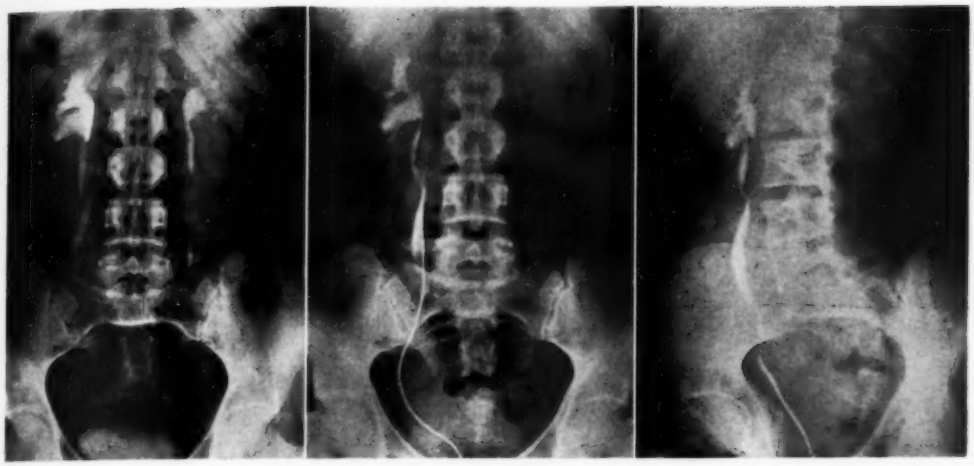

Fig. 3. Intravenous pyelogram on 34-year-old woman showing bilateral vascular defects in the ureters, probably due to the ovarian vessels crossing anterior to the ureters.
Fig. 4. Retrograde pyelogram on same patient demonstrating the unusually large vascular defect on the right.
Fig. 5. Oblique retrograde roentgenogram on same patient, showing that the vascular defect is anterior and that the ureter is at a greater distance from the spine than would be expected with a circumcaval ureter.

have represented a pelvic venous thrombosis. This might have contributed to the larger size of the ovarian veins by virtue of increased collateral circulation. Although the defect was more pronounced on the right, it was bilateral. These defects are not large enough to surround the vena cava, produce no deviation of the ureter, and no hydronephrosis. On oblique or lateral views the ureter lies some distance anteriorly to the spine. We have seen this phenomenon occurring in other patients but to a less noticeable degree, especially when the patient is thin and compression devices are used.

The second instance occurs when the ureter lies close to the psoas muscle and, as it swings slightly medial from the ureteropelvic junction, forms a sharp loop over the anterolateral portion of this muscle. In the presence of such a condition, the curve in the ureter straightens out upon insertion of a catheter and there is no significant medial displacement or hydronephrosis. This curved defect, if viewed on oblique or lateral urograms, has its convexity anterior which is the reverse of the finding with an actual vascular structure crossing anterior to the ureter.

TREATMENT

In cases in which hydronephrosis is absent, a conservative management may be the best course. When severe hydronephrosis exists and no salvageable renal tissue remains, nephrectomy is the treatment of choice.

In cases where hydronephrosis is present but the right kidney is worth saving, some sort of plastic procedure should be attempted. Such a procedure was first done by Kimbrough (10) in 1935. The ureter is freed in its course around the vena cava and divided. It is then returned to its normal position and the divided segments are anastomosed. Plastic procedures have been attempted in 18 cases. Fourteen of these patients had satisfactory results following the single plastic procedure. Lyter and Meyer (40) found it necessary to perform a second operation for torsion, following which the result was satisfactory. In Lowsley's patient (28) a stricture developed postoperatively. The patient of Nourse and Moody (31) subsequently underwent a nephrectomy because of a stricture and the formation of a stone.

In 14 cases nephrectomy has been performed. In two other instances (Rotter, 11;

Young, 32), removal of a calculus was the only procedure.

SUMMARY

An additional case of right retrocaval ureter in which typical x-ray findings were present has been reported. The literature has been reviewed, with special emphasis on the anatomic and x-ray findings in the previously described cases.

Cleveland Clinic
Cleveland 6, Ohio

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SUMARIO

Uréter Circuncavo

Comunícase un caso de uréter circuncavo, repásase la literatura y tabúlanse los pormenores pertinentes de 55 casos descritos anteriormente.

La anomalía fundamental radica en el aparato vascular, consistiendo en desarrollo anormal de la vena cava. Se han reconocido por lo menos cinco variaciones del estado: (I) La más común, representada por el caso actual, es el uréter circuncavo derecho con una sola vena cava derecha. Las menos frecuentes son: (II) doble cava derecha, pasando el uréter entre las dos venas; (III) cava bilateral con uréter circumcavo derecho; (IV) cava bilateral con uréter circuncavo bilateral; (V) cava bilateral con uréter doble a la derecha.

No cabe hacer el diagnóstico más que con la radiografía. Los hallazgos más constantes son desplazamiento del uréter hacia la línea media a la altura de las tercera y cuarta vértebras lumbares, hidronefrosis e hidrouréter. En los casos en que la oclusión es más evidente y la hidronefrosis pronunciada, la porción superior del uréter y la pelvis están alargadas, se vuelven exuberantes y forman una curva falciforme o en S.

Investigation of Cause of Lymphedema of the Upper Extremity After Radical Mastectomy

JOE M. PARKER, M.D., P. E. RUSSO, M.D., and D. L. OESTERREICHER, M.D.
Oklahoma City, Okla.

THE PATHOGENESIS of lymphedema of the upper extremity following a radical mastectomy is not as yet completely understood. A conspicuously swollen arm may be the only noticeable evidence of a radical mastectomy. Rarely a lymphangiosarcoma of the edematous arm may ensue after a prolonged period (1). Since the only known treatment of the condition is its prevention, we have been encouraged to investigate this problem.

Our interest was stimulated by a patient in whom thrombophlebitis of the veins of the forearm occurred following a radical mastectomy. The arm was bandaged with elastoplast for a period of two months. To our surprise swelling of the arm did not develop in spite of the severe thrombophlebitis. As a result of this experience, prophylactic bandaging of the arm of all patients subjected to radical mastectomy was tried. In 50 consecutive cases in which this procedure was employed, no appreciable edema of the arm, such as could be classified as moderate or severe, ensued. The routine use of this prophylactic measure was the subject of a previous publication (2). This experience led us to believe that venous obstruction is probably the primary factor in the production of lymphedema of the arm. To substantiate this assumption, we have undertaken to investigate this problem by measurements of venous pressure, venograms, and use of anticoagulants.

Halsted (3) in 1921 published a paper entitled "Swelling of the Arm After Operations for Cancer of the Breast—Elephantiasis Chirurgica—Its Causes and Prevention." It was his opinion that "although blocking of the lymphatics and occasionally also of the veins is the underlying factor, infection plays a conspicuous part in the determination of the amount of swelling and the time of its manifestation."

Devenish and Jessop (4) attributed postoperative swelling to lymphatic obstruction and regarded the rise in venous pressure occurring during exercise as a factor in edema formation after the occurrence of such obstruction. They stated that postoperative swelling occurs in 1 of 6 cases.

Macdonald (5) considered obesity the most important predisposing factor in the genesis of lymphedema. In his opinion, the sequence of events is fat necrosis in the operative field, followed by secondary infection with regional (perivenous) axillary lymphangitis and resulting sclerosis and obstruction. He advocates resection of the axillary vein in cases with axillary lymph node involvement to permit more complete dissection and as a prevention of swelling of the arm.

Veal (6) pointed out that there are three types of edema—lymphangitic, venous, and a combination of the two. He included cases with recurrent cancer in his study and, making use of venograms, formulated the following conclusions: "Edema resulting from obstruction of the axillary and subclavian veins is by far the most common cause of swelling of the arm following operation. The most frequent cause of the venous obstruction is recurrence of the malignancy along the course of the veins. In some cases the venous occlusion results from benign scar formation . . . Lymphatic stasis is a secondary result of venous obstruction if prolonged and will lead to permanent blockage of the lymphatic flow. Infection is prone to develop and may lead to further

[1] From the Departments of Surgery and Radiology, University Hospitals, Oklahoma City, Okla. Presented at the Thirty-seventh Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 2–7, 1951.

obstruction and cause a greater degree of swelling."

Holman *et al.* (7), in a review of 100 cases, found the incidence of severe swelling of the arm—6 cm. or more—after radical mastectomy to be 11 per cent. From their study these authors concluded that skin grafting did not influence postoperative edema; that swelling of the arm cannot be assumed to signify recurrence of the carcinoma; that presence or absence of involved nodes in the axilla has no bearing on the swelling; and finally, that the chief causative factors are infection and roentgen dermatitis.

Daland (8), in a more recent article on this subject, advocates avoidance of sepsis, the Greenough modification of the Rodman incision (in which the incision does not extend onto the arm), drainage for three to five days (serum accumulation under the flaps causes fibrosis), avoidance of postoperative irradiation (as it does not prevent recurrences) or its administration in such a manner as not to cause fibrosis, and, most essential, "early mobilization of the arm."

This brief résumé clearly shows that there is considerable difference of opinion as to what factors are responsible for lymphedema of the arm after radical mastectomy. Is it lymphatic, venous, or a combination of both? It is agreed that no treatment is satisfactory after the swelling occurs and that the prevention of this complication is of primary concern. Here again there is difference of opinion as to how to avoid it. Most authors agree that sepsis plays an important part. Postoperative irradiation has been mentioned as a causative factor. Swelling of the arm has been said to be proportional to the amount of irradiation given, although none of those making this claim state either the dosage or method of administration.

The etiology of edema of the leg has been better understood as a result of studies of venous pressure during exercise (9, 10). It has been demonstrated that valvular incompetence with a sustained high venous pressure equivalent to the hydrostatic level of the fluid is responsible for the swelling of the leg. Veal and Hussey (6) applied venous pressure tests to the arm. Normally, venous pressure in the arm becomes elevated with exercise. It was their finding that patients with postoperative lymphedema of the arm showed venous pressure considerably above normal, particularly during exercise of the arm. On the other hand, it is well known that venous pressure in the leg falls rapidly with exercise, due to the milking effect of the muscles on the veins, and the restraining effect of the valves. Valvular incompetence, it appears, plays no major role in lymphedema of the arm, whereas it is of paramount importance in the leg.

It is our belief that lymphedema is the result of early venous blockage, or partial obstruction, and that a chronic indurated upper extremity is the result of early venous blockage plus later local tissue changes which lead to the establishment of permanent and resistant lymphedema. We agree partly with Veal's third theory, namely, that a combination of venous and lymphatic blockage is responsible for postmastectomy lymphedema. We would disagree, however, as to the sequence, inasmuch as venous blockage is an early and temporary complication. With persistent high venous pressures, local extracellular and osmotic pressure systems become affected so that edema eventually becomes a permanent feature. We believe that wrapping the arm prophylactically during the early phase of venous blockage will prevent subsequent permanent edema. How else can one explain an indurated arm when changes in the axillary vein incident to careful stripping are seen to develop within four days of operation and then resolve completely within a period of two to three months?

Since mural thrombus formation was thought to be a possible cause for venous obstruction, anticoagulants were tried. This approach to the problem was abandoned early because of the uncontrollable oozing of the wound, permitting massive hematomas to develop on the chest wall.

The earliest studies with venous pressures and venograms were done during the first week after radical mastectomy. For the venograms, 20 c.c. of 35 per cent Diodrast was injected rapidly into the medial antecubital vein and several exposures were made with a Fairchild rapid-film apparatus with one second interval between films. The patient executes a Valsalva maneuver during the injection to elevate the intrathoracic pressure so that the dye remains in the axillary and subclavian veins for a longer period of time. Subsequent venous pressures and venograms were obtained at intervals of two or three months. More recently routine preoperative venous pressure determinations and venograms are being made in these cases. It has been found that injection of the dye into the lateral antecubital vein is unsatisfactory, since it produces excellent visualization of the cephalic vein, but the axillary is poorly filled or not at all. The use of serial films may help to distinguish between spasm and organic changes. Usually 5 films are taken with each injection.

Our present series of cases is too small to warrant any final conclusions. The following observations have been made. Venous pressures in the arm rise considerably above normal shortly after a radical mastectomy. Following axillary dissection, definite changes of the vein can be demonstrated on the venograms. An area of constriction is seen lateral to the border of the scapula. These changes may be due either to spasm or organic alterations. The latter explanation seems to be more likely. The anterior and inferior surfaces of the axillary vein are stripped thoroughly

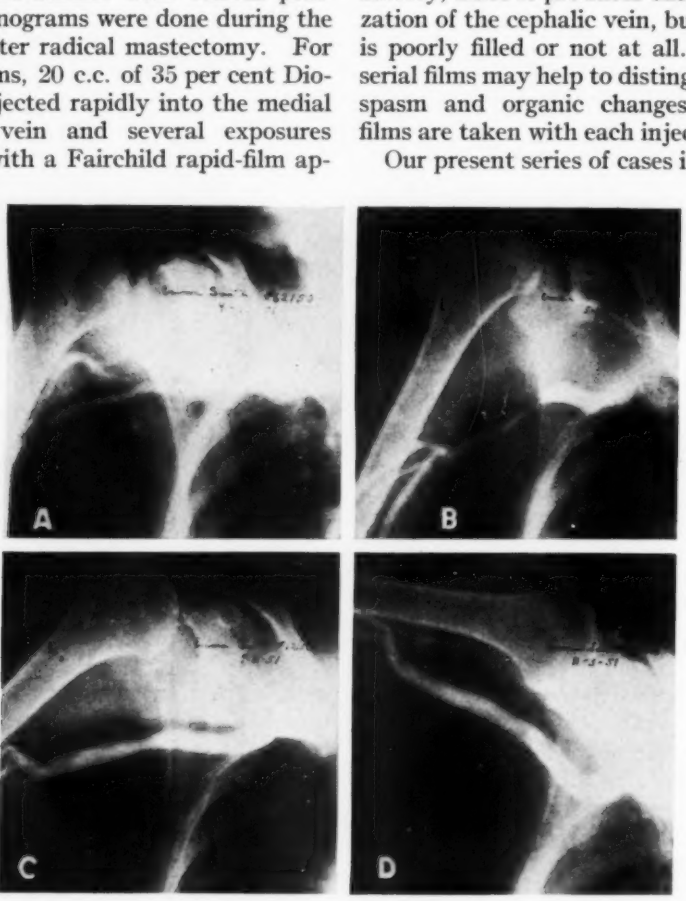

Fig. 1. Case I. A. Venogram obtained April 13, 1951 (tenth day after radical mastectomy). The axillary vein is narrow and irregular. B. Venogram of May 21, 1951, showing further constriction of the axillary vein. C. Venogram of July 11, 1951, showing the vein returning to normal size. D. Complete restoration to normal, Nov. 3, 1951.

during a "complete" axillary dissection. The largest vessels to be ligated are the subscapular artery and vein. It is in this area of the vein that the changes of the lumen are seen. The formation of a mural thrombus in the axillary vein where the subscapular is ligated is a likely possibility.

was done on April 2, 1951, and the first venograms were obtained eleven days later. The axillary vein was narrow and irregular. Venography was repeated after two months, and the axillary vein appeared more irregular and narrow in outline than before. Venograms taken after intervals of four and seven months show the lumen of the vein restored to its normal size.

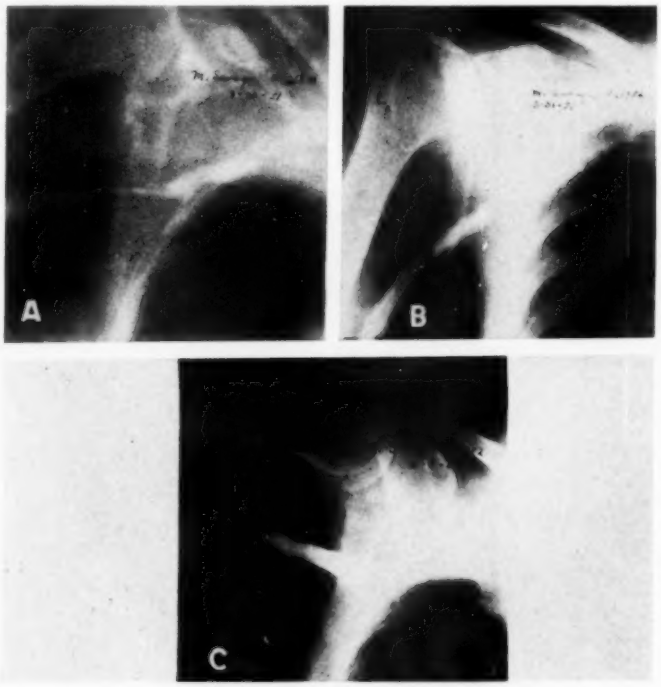

Fig. 2. Case II. A. Venogram of March 22, 1951 (fifth day after radical mastectomy), showing the axillary vein narrow and deformed. B. Venogram of May 31, 1951, showing hour-glass constriction of the axillary vein at the outer border of the scapula. C. Restoration of the vein to normal, Nov. 3, 1951.

The exact nature of this constriction is difficult to determine unless postmortem material becomes available. Some of these changes in the axillary vein have been observed in venograms taken as long as three months after surgery.

A few illustrative cases are presented in making this preliminary report. All the patients were females with malignant disease of the breast treated by radical mastectomy. None received deep x-ray therapy either before or after the operation.

CASE I (Fig. 1): E. M.: A radical mastectomy

Venous pressure had returned to normal and no swelling of the arm was demonstrable at the last examination.

CASE II (Fig. 2): This patient had a tumor of the breast 15 cm. in diameter with lymph nodes measuring up to 5 cm. in the axilla. The first venograms were obtained on the fifth postoperative day. The axillary vein was constricted for a distance of 3 cm. When the venogram was repeated, two months later, an hourglass constriction of the vein just lateral to the outer border of the scapula was still present. The last venogram was taken seven months after the operation and shows the vein restored to its normal size. Venous pressures rose to 26 cm. H_2O the first week after the operation and dropped

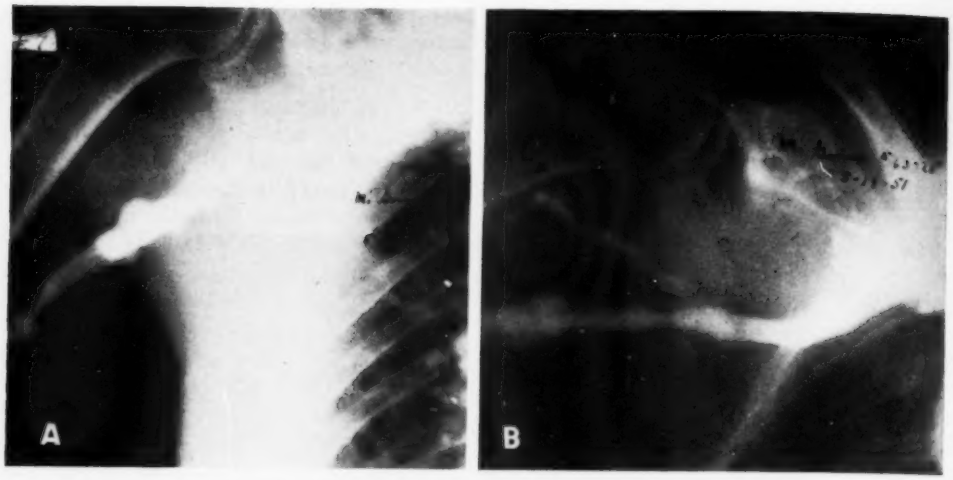

Fig. 3. Case III. A. Preoperative venogram, May 12, 1951. B. Postoperative venogram, May 19, 1951, showing hour-glass constriction at the outer border of the scapula.

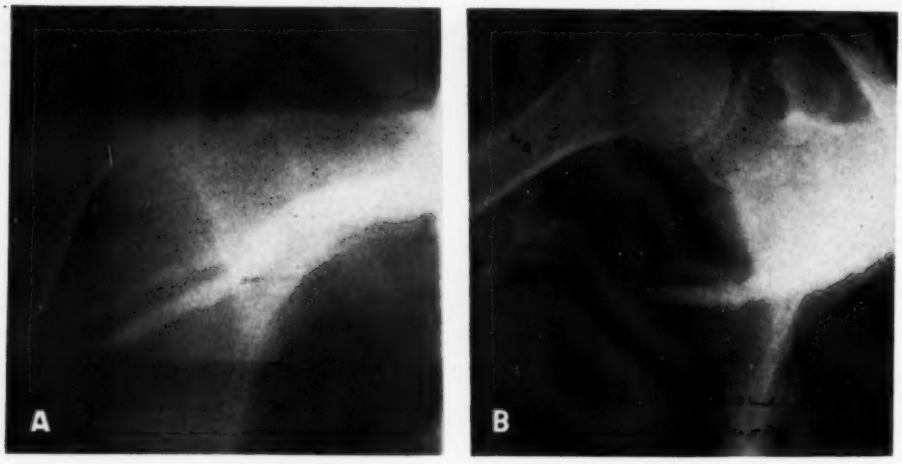

Fig. 4. Case IV. A. Preoperative venogram, Aug. 24, 1951. B. Postoperative venogram, Nov. 5, 1951, showing minimal changes in the axillary vein.

to 16 cm. after an interval of two months. No appreciable edema of the arm developed.

CASE III (Fig. 3): This was our first patient to have a preoperative venogram to show the axillary vein before surgery. Venography was repeated on the fifth postoperative day, showing an hour-glass constriction of the vein. It was this case that determined us to discontinue the use of anticoagulants. The patient almost bled to death. We have been unsuccessful in obtaining follow-up studies.

CASE IV (Fig. 4): This case is shown because it is the only one studied so far in which the axillary vein shows no appreciable difference in the venograms taken before and after surgery.

CASE V (Fig. 5): This case demonstrates what happens when the dye is injected into the lateral antecubital vein. Only the cephalic vein is visualized both in the preoperative and postoperative venogram. It was impossible to locate the medial antecubital vein on this patient.

CASE VI: P. B. G.: Five days following a radical mastectomy (March 3, 1951) the first venogram was obtained. The axillary vein looked very narrow. In another venogram, nine days later, the vein was not only narrow but irregular

in outline. These studies were repeated at intervals of two, four, and seven months, and no appreciable changes of the axillary vein were noted, except that a communicating branch was visualized on the later films. Venous pressure recorded as 11 cm. of H_2O before surgery rose to 33 cm. in the first week after the operation. It had dropped to 22 cm. after an interval of seven months. This patient had no appreciable swelling of the arm.

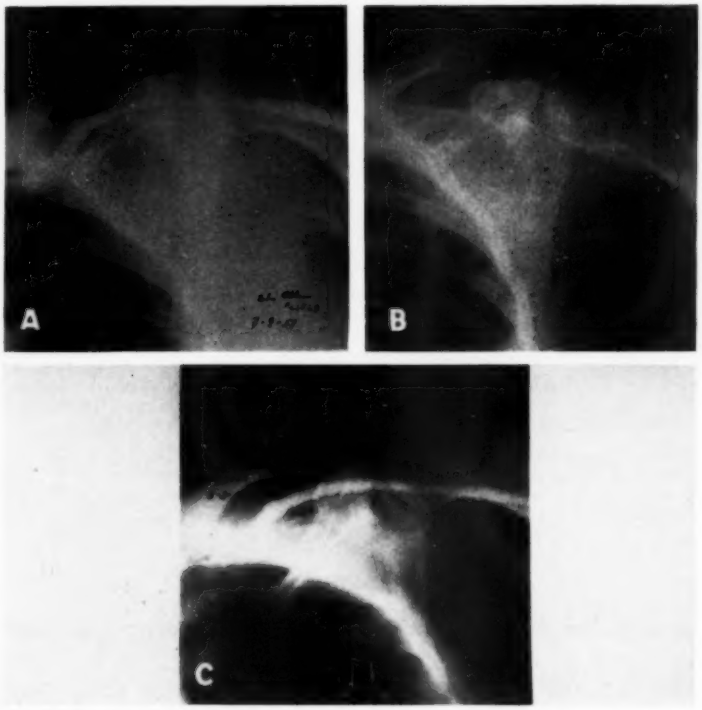

Fig. 5. Case V. A. Preoperative venogram, July 9, 1951, following injection of dye into the lateral antecubital vein. The cephalic vein is clearly visualized. B and C. Postoperative venograms at ten days and three months, respectively, following surgery. Again the dye was injected into the lateral antecubital vein and only the cephalic vein is demonstrated.

Our present series of cases is too small to warrant any final and complete conclusions. We have, however, demonstrated several changes in the veins of the axilla that appear worth reporting at this time and that merit further study. As mentioned previously, Veal and Hussey found that venous pressures rise normally during exercise, and that following radical mastectomy they may frequently reach values five times above normal, especially during exercise. Our venous pressure recordings suggest a similar rise in the venous pressures of the post-mastectomy arm, but our experimental data on this point are as yet insufficient for any conclusions.

We have been able to demonstrate a narrowing in the axillary vein of most patients subjected to radical mastectomy. The area of constriction is constant in location and is seen lateral to the border of the scapula. The changes in the axillary vein are apparently of a temporary nature, inasmuch as all of our cases so far studied have, with one exception, shown restoration of the normal caliber of the vein over a period of four months. It might be added here that in the one patient with persistent axillary vein narrowing, the venous pressures have also remained elevated.

The exact nature of the constriction in the axillary vein lateral to the border of the scapula is not completely understood. It is situated anatomically in the area of the junction of the subscapular vein with the axillary vein. The subscapular vein is the largest branch of the axillary vein. We believe that the reduced caliber of the axillary vein is due to organic changes in the wall of the vein and not to a local spasm. The constancy of the defect would bear out this conclusion. The constriction, we believe, is most likely in the nature of a mural thrombus forming at the site of the ligated subscapular vein. We also believe that this mural thrombus persists for a period of two to four months and that during this time the venous pressures are elevated. It is in this phase that elastic bandaging of the arm is imperative if an eventual indurated upper extremity is to be avoided.

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University Hospitals
Oklahoma City, Okla.

SUMARIO

Investigación de la Causa del Linfaedema del Miembro Superior Consecutivamente a la Mastectomía Radical

Habiendo observado que el vendaje del brazo después de la mastectomía radical impedía aparentemente la aparición de edema linfático postoperatorio, los AA. pasaron a deducir que la oclusión venosa era probablemente el factor primario en la etiología de dicha complicación.

Investigaron dicha posibilidad por medio de mediciones de la presión venosa y de la venografía, antes de la operación y a ciertos plazos después. Para los venogramas inyectaron 20 cc. de Diodrasto (35 por ciento) en la vena antecubital media, tomando radiografías con un aparato de radiografía veloz de Fairchild.

Aunque la serie de casos estudiados es demasiado pequeña para sacar conclusiones definitivas, observóse que la tensión venosa en el brazo se elevaba considerablemente sobre lo normal poco después de una mastectomía radical, y que consecutivamente a la disección axilar aparecían en el venograma alteraciones bien definidas y notablemente una zona de constricción venosa a un lado del borde del omoplato. La formación de un trombo parietal en el sitio de la ligadura de la vena subescapular, que es la principal afluente de la axilar, pasa por ser una posibilidad, pero no cabe determinar la naturaleza exacta de la constricción sin una autopsia.

En todos los casos, menos uno, de los AA., se restableció el calibre normal de la vena en término de cuatro meses. Es durante ese período postoperatorio inmediato que resulta imperativo el vendaje elástico si se desea evitar la induración permanente del brazo.

DISCUSSION

D. S. Beilin, M.D. (Chicago, Ill.): As the authors state, this is a preliminary report and has been presented to reopen the subject of lymphedema of the arm following radical mastectomy. Their studies of venograms of the axillary vein showed definite changes following radical mastectomy, revealing that these changes may be observed as long as three or four months later. It is their belief that early venous blockage or partial obstruction plus later chronic tissue changes leads to the establishment of permanent and resistant lymphedema and a chronically indurated upper extremity.

Macdonald of the University of Southern California, Nelson Percy of Chicago, and others, feel that post-mastectomy swelling of the upper extremity is due primarily to lymphatic obstruction and probably is not directly dependent upon venous resection or destruction. It is their impression that lymphedema is caused by lymphangitis secondary to a low-grade infection which probably ends in lymphangitic sclerosis, and that the extent of this change determines the degree of edema. Nearly all observers have noticed that obesity appears to be the most prominent predisposing factor.

One will have to wait until postmortem or biopsy studies have been obtained in order to have a more factual concept as to the pathogenesis of lymphedema.

A Study of Distribution with Seven Major Modifications of the Transvaginal Method[1]

ARTHUR W. ERSKINE, M.D.

Cedar Rapids, Iowa

THOSE WHO USE the transvaginal attack on cervical cancer can be divided into two groups. The purpose of one group is to increase the homogeneity of radiation throughout the pelvis and to try to deliver a lethal dose of x-rays to cancer cells wherever they may be. They properly use long distances, penetrating rays, and multiple fields. The other group uses the method to administer a destructive dose to the primary lesion in the cervix and as large an area as possible immediately surrounding it. Most of the members of this group try in one way or another to deliver a large dose to the lateral vaginal fornices. They seek to avoid an extremely penetrating beam which can injure the intestines, bladder, and rectum, and they like to have a considerable amount of radiation absorbed in the first 3 or 4 cm. The object of the present study is to see how well the various modifications of the transvaginal method achieve the purpose of the second group.

The method used for the study is shown in Figure 1. Measurements in a water phantom are difficult to make for many reasons. We used a masonite block with the measuring instrument fixed in it. Instead of moving the ionization chamber in the phantom, we moved the whole block and the measuring instrument across the beam by a rack and pinion. Surface measurement and measurements at 3 cm. depth were made at the center of the field or, in the case of multiple fields, in the center of the aggregate field, and at distances of 1, 2, 3, 4, and 5 cm. from the center, the shift being made transversely, vertically, and diagonally. It was possible to reproduce the position of the chamber with considerable accuracy. As shown in the illustration, the various specula were surrounded by very closely fitted blocks of masonite. The study required approximately 6,000 measurements. These unquestionably contain some errors, since it was impossible to plot curves from which we could find the most probably correct value.

The method used to measure the intensity in air is open to criticism. To avoid errors in measuring the distance, the ionization chamber was not suspended freely in air but was left embedded in the surface of the phantom, which was covered with thick lead. An aperture measuring 9 × 12 mm. was cut in the lead, which fitted snugly around the ionization chamber. The so-called "air measurements" were therefore increased by back-scatter from about 1 sq. cm. of the phantom. The results of the measurements were then tabulated, showing the intensity at various points expressed as roentgens per 100 r in air. From this table graphs were plotted. The first twelve graphs (Fig. 2) show the distribution with the easiest and least efficient modification of the transvaginal method, that is, the exposure of a single circular field through an opaque cylindrical speculum. Roentgens per 100 r in air at the surface are indicated by solid lines, and at 3 cm. depth by broken lines. We studied the distribution with fields 3 cm. and 3.6 cm. in diameter at 35 and 25 cm. distance, with and without filtration, using 200 kv. Filtered and unfiltered rays produced at 135 kv. were studied at 25 cm. distance only. For the graphs straight lines are used, though curves would show the distribution better.

The graphs numbered 13 to 24 (Fig. 3) show the distribution when a single cir-

[1] This material was used in a Refresher Course on Transvaginal X-Ray Therapy presented at the Thirty-seventh Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 2-7, 1951.

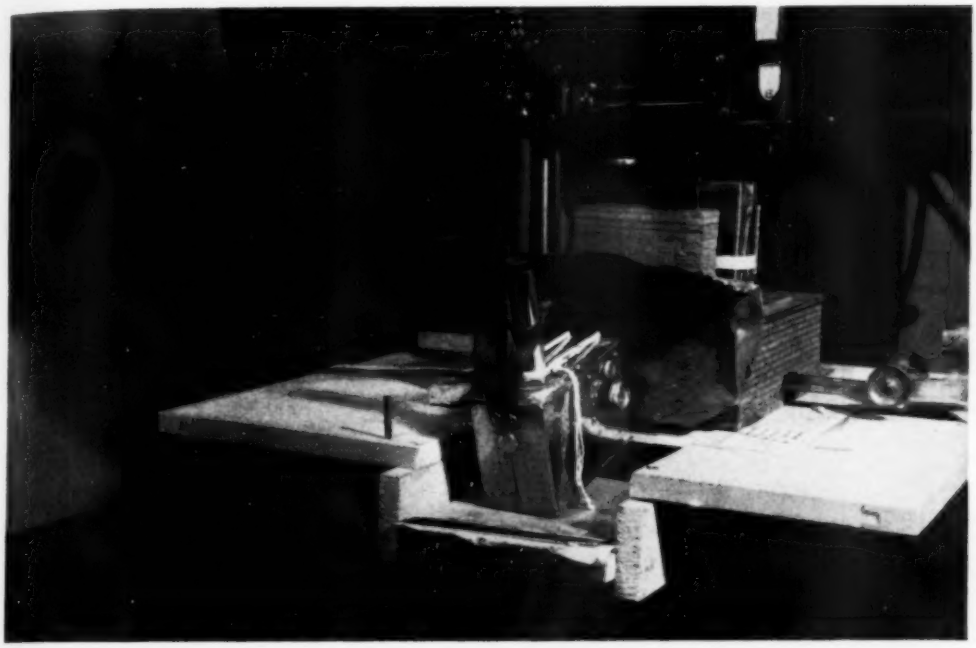

Fig. 1. The apparatus used in making the measurements. The masonite block with the ionization chamber in it was moved across the beam in various directions. Blocks on the base board ensured accurate centering of the specula.

cular field is exposed through the transparent cylindrical specula first used by E. A. Merritt. If we compare corresponding graphs with identical technics, it is apparent that distribution has been considerably improved. The depth dose at the edge of the field is about twice as large as when an opaque speculum is used. Because the vaginal wall receives a very large dose, probably a transparent speculum should always be used when the vagina is involved.

Graphs 25 to 28 (Fig. 4) show the distribution with the rectangular, expanding, four-bladed speculum developed by the author. This instrument can be used at 28 cm. distance only. The graphs show the distribution for both filtered and unfiltered rays at 200 and 135 kv. Incidentally, 0.25 mm. copper is too much for maximum efficiency and economy with 135 kv. The intensity is so reduced that the treatments require too long a time. The filter thickness should be between 0.1 and 0.15 mm. of copper or brass. The graphs for all groups show that the depth-dose percentage is too low with unfiltered rays produced at 135 kv.

The next four graphs, 29 to 32, in the upper half of Figure 5, show the distribution when two half-oval adjacent fields are exposed through the half-oval, half-transparent speculum suggested by Howard Hunt. The distribution is rather good, especially with unfiltered rays produced at 200 kv. (Graph 30). All of us who have used half-oval fields have suffered from the fear that the fields would overlap even though we have used a periscope to check the position of the speculum. Graphs 33 to 36, in the lower half of Figure 5, show that if the fields overlap 1 cm., the center of the aggregate field receives a a serious overdose. Graphs 37 to 48 (Fig. 6) show the distribution with three overlapping circular fields, as used by Twombly. The factors were the same: 200 kv., with and without a filter, at 25

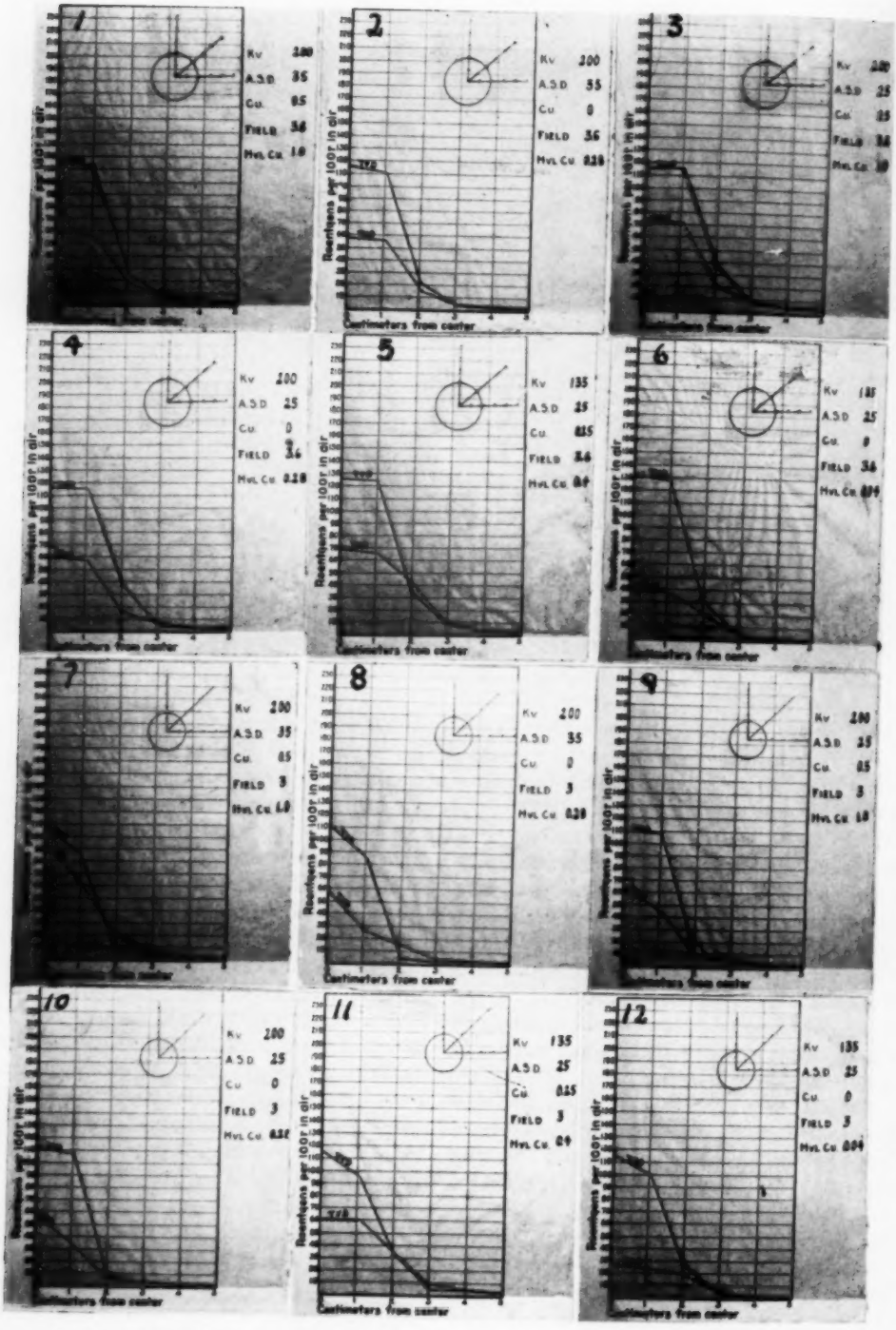

Fig. 2. Distribution in single circular fields exposed through an opaque cylindrical speculum.

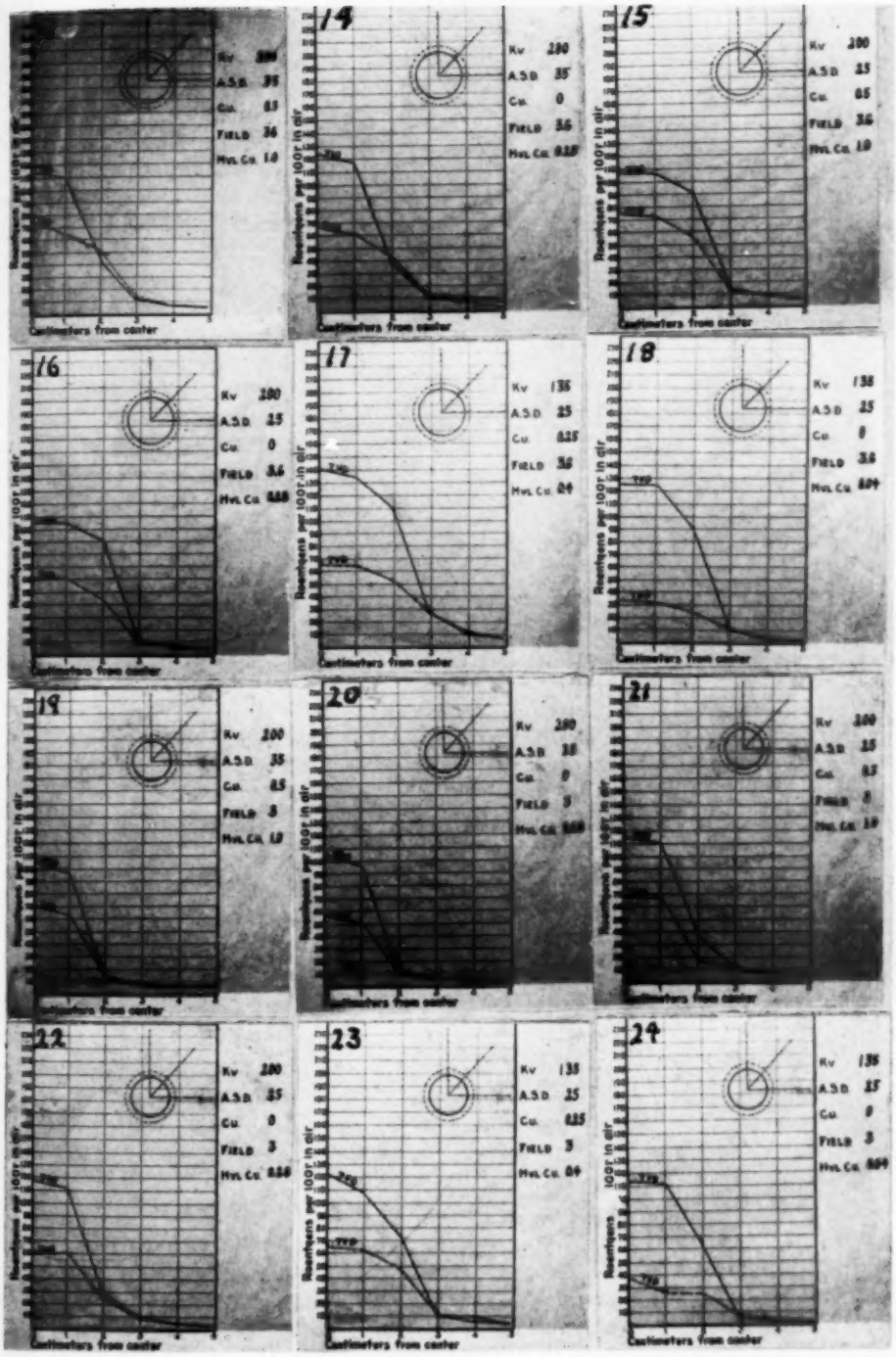

Fig. 3. Distribution in single circular field exposed through transparent cylindrical speculum (Merritt).

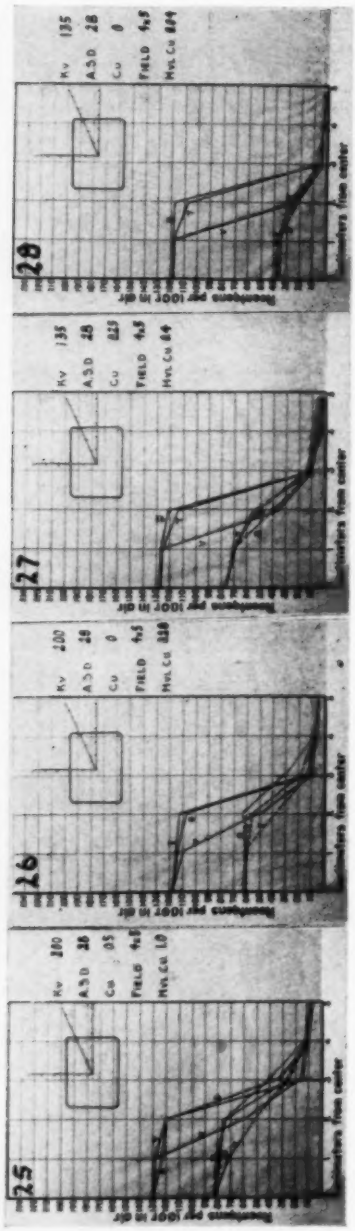

Fig. 4. Distribution in single rectangular field exposed through four-bladed expanding speculum (Erskine).

and 35 cm., with 3.6 and 3 cm. fields, and 135 kv., with and without filtration, at 25 cm., with 3.6 and 3 cm. fields. The depth-dose graph has become more nearly level, especially with the transverse and diagonal shifts. There are some "hot spots" where the fields overlap. So far, however, the three overlapping fields give the best distribution.

The six graphs in Figure 7 numbered 49 to 54, show the distribution with five overlapping circular fields (diameter 3 cm.) arranged symmetrically, as described by Wasson in 1943. The depth-dose curves are good, although there are some "hot spots" at the surface where the fields overlap. The last six graphs, 55 to 60, (Fig. 8) show the results of the measurements in five fields arranged so that the aggregate field is rectangular in shape. The "hot spots" persist, but the depth doses, especially with the transverse and diagonal shifts, level out very well.

These graphs show a definite pattern for each variation of the seven major modifications of the transvaginal method. None is perfect. A review of the data and the graphs shows that adoption of the following principles tends to improve distribution:

1. A short distance produces a rapidly expanding beam, shortens the length of the treatments, and lessens the danger of injury to the bladder, rectum, and intestines resulting from too high depth-dose percentage.
2. A rectangular field or aggregate field permits more nearly adequate dosage to the lateral vaginal fornices and lessens the danger of cystitis and proctitis.
3. The use of lightly filtered or unfiltered rays shortens the treatments and prevents too high a depth-dose percentage.
4. Multiple fields ensure adequate dosage to the lateral fornices and tend to equalize the depth dose in a large aggregate field.

The use of multiple fields is extremely difficult and requires more gynecological skill than most of us have. I have drawn, in Graph 61 (Fig. 9) what I believe would be ideal distribution if we could get it. The nearest approach to it is Graph 40, with three overlapping circular fields. How can we most easily eliminate the "hot

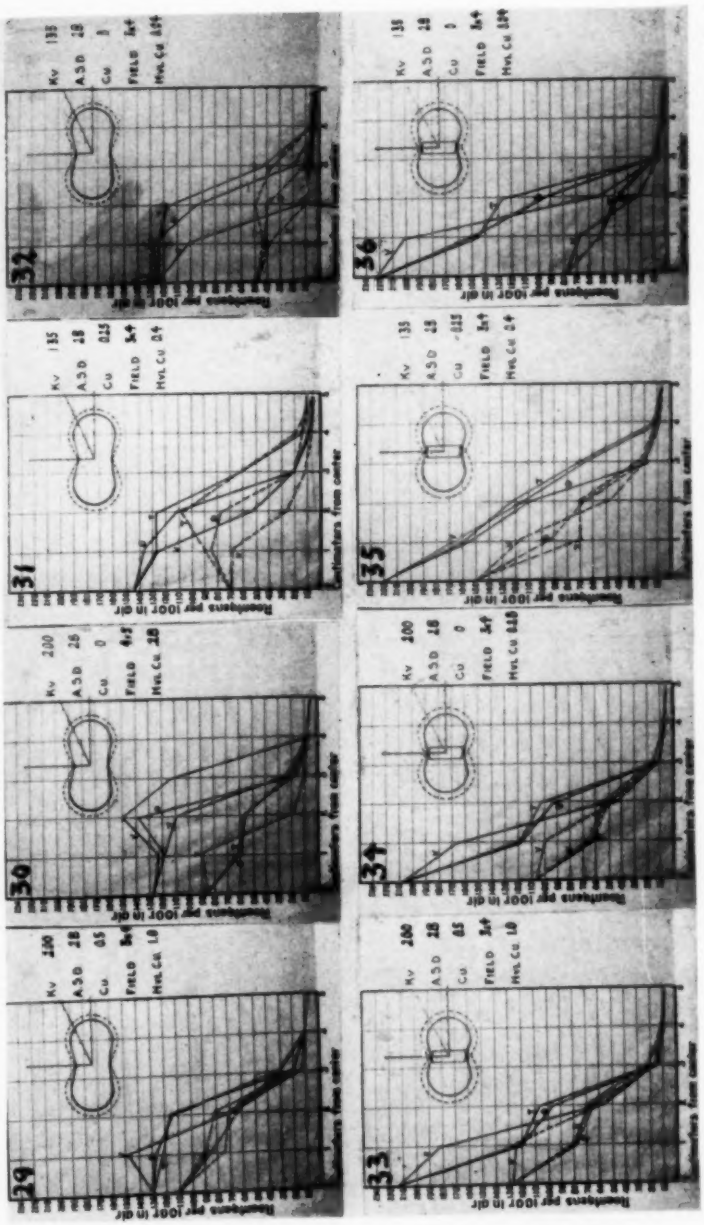

Fig. 5. Graphs 29, 30, 31, and 32 show the distribution in two adjacent half-oval fields exposed through a half-transparent speculum (Hunt). Graphs 33, 34, 35, and 36 show overdosage to the center of the aggregate field due to overlapping.

spots" in the three-overlapping-field technic? Would not rectangular, adjacent fields be better? It has also been suggested that we might use an opaque rectangular speculum for the central field and a half-transparent rectangular speculum for the two outer fields. Graph 62 shows the distribution with such a technic. It is very good, but the danger of overlapping remains. Graph 63 shows the "hot spots" resulting from the overlap of only 3 mm. Perhaps someone may have enough ingenuity to devise some purely mechanical method of accurately placing and holding

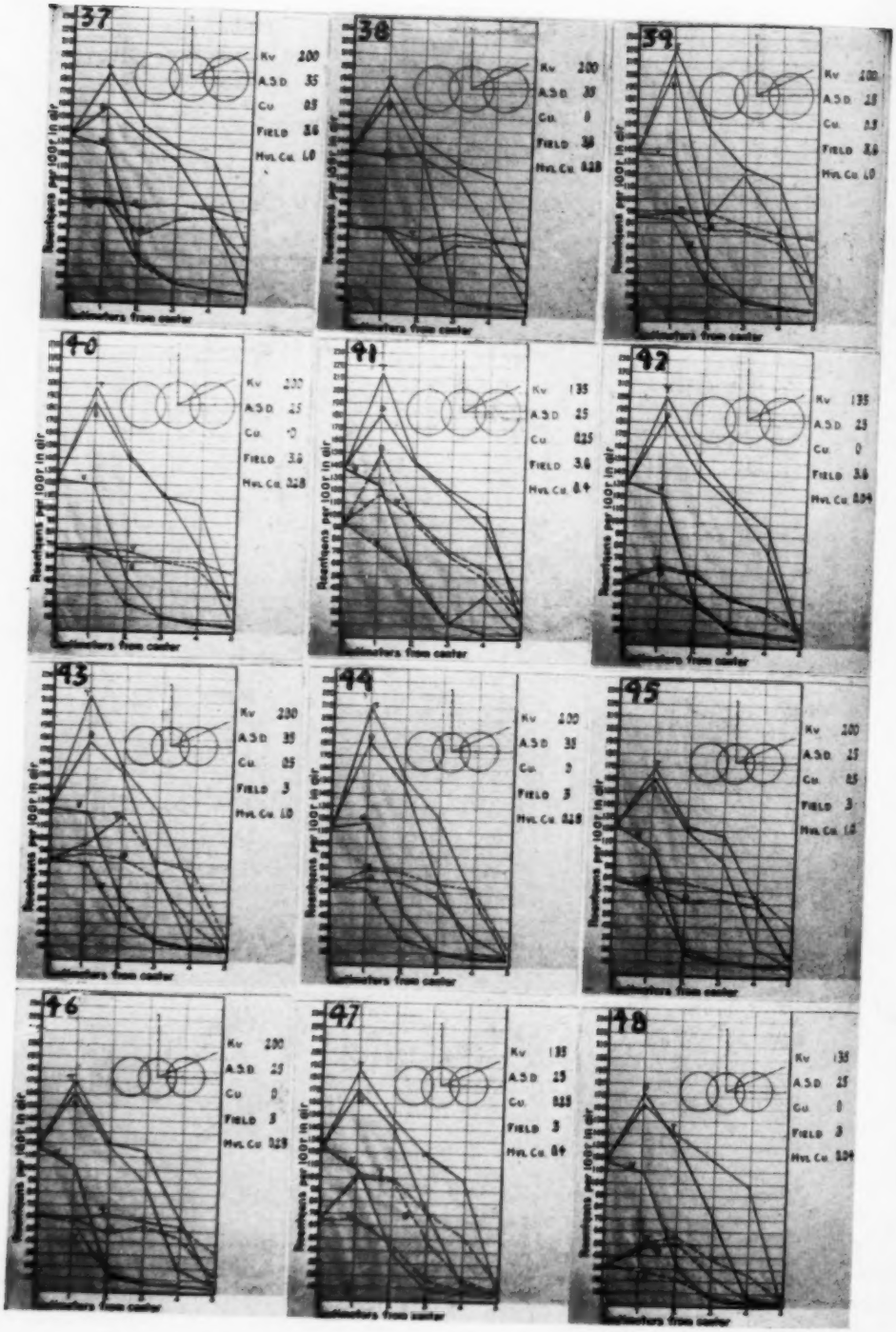

Fig. 6. Distribution in aggregate of three overlapping circular fields (Twombly).

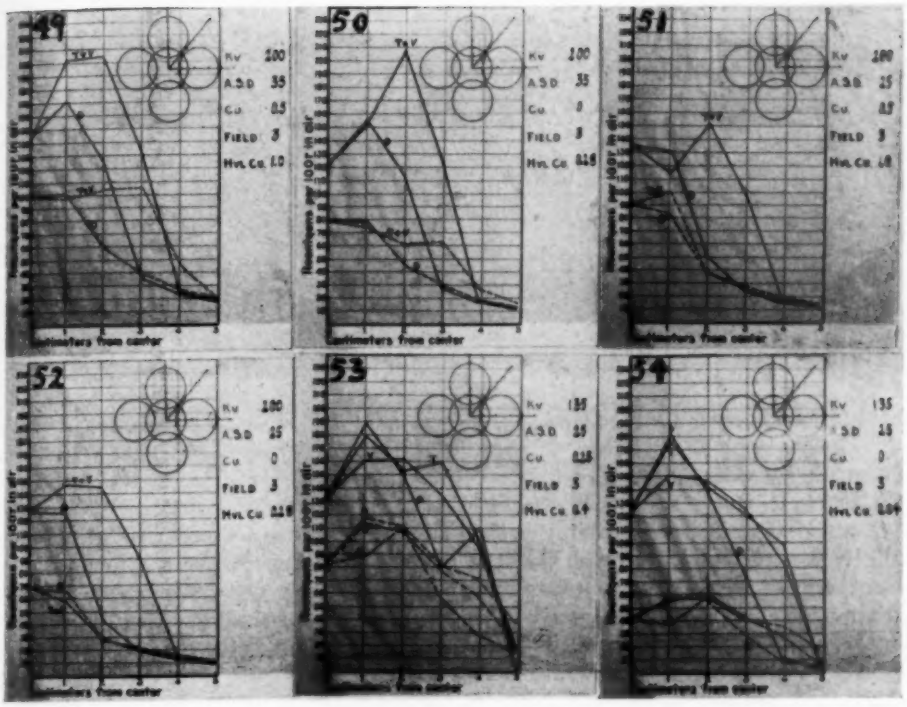

Fig. 7. Distribution in aggregate of five overlapping circular fields arranged symmetrically (Wasson).

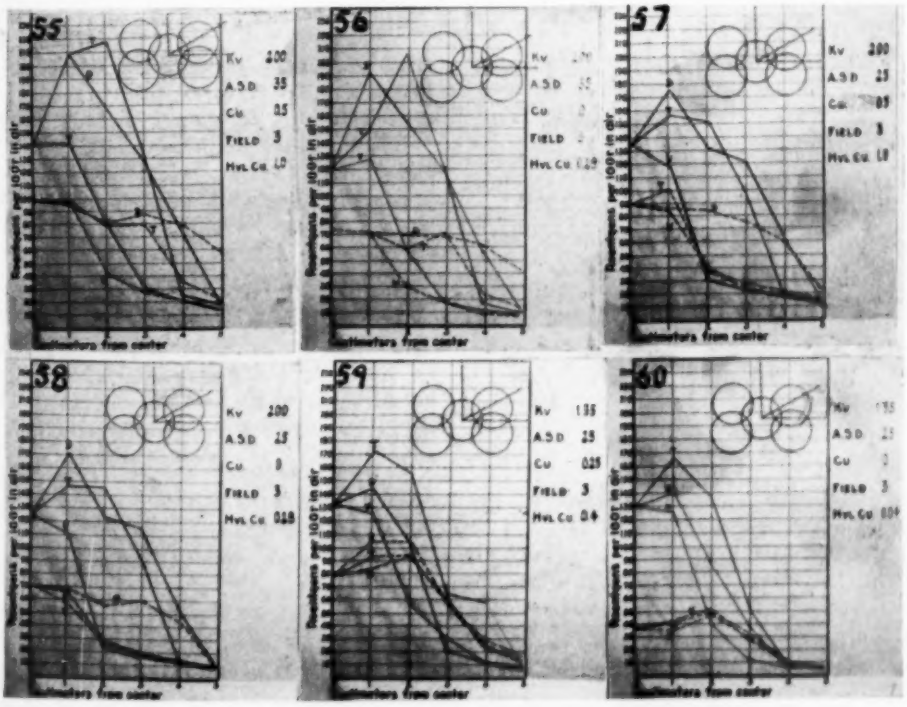

Fig. 8. Distribution in aggregate of five overlapping circular fields arranged rectangularly.

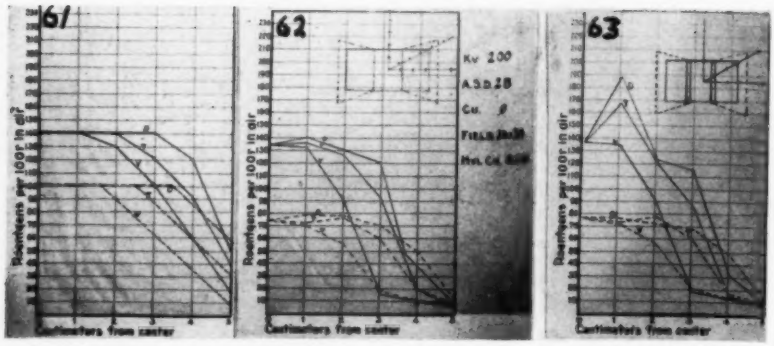

Fig. 9. Graph 61 shows, by arbitrarily drawn lines, ideal distribution in a rectangular field. Graph 62 shows the actual distribution in an aggregate rectangular field. The central area was exposed through an opaque rectangular speculum, the adjacent lateral areas through a half-transparent rectangular speculum. Graph 63 shows overdosage due to overlapping fields.

the specula so that overlapping is impossible. I venture to suggest that some thought might be directed toward the solution of this problem. For example, the most valuable thing about the Ernst radium applicator is its absolute fixation of the various sources of radiant energy in relation to the cervical canal. When mechanics wish to reproduce a piece of work exactly, they use a "template." Might we not apply similar principles to the use of multiple fields in transvaginal therapy?

326 Higley Bldg.
Cedar Rapids, Iowa

SUMARIO

Estudio de la Distribución de la Dosis con Siete Importantes Modificaciones de la Tecnica Transvaginal

Por medio de una cámara de yonización fijada en un canto de masonita, hízose una determinación de la distribución de la dosis en siete de los métodos reconocidos más generalmente de irradiación transvaginal.

Las gráficas obtenidas revelaron un patrón bien definido para cada variación de las siete grandes modificaciones de la técnica transvaginal. Ninguna es perfecta. Un repaso de los datos acopiados y de las gráficas demuestra que la adopción de los siguientes principios tiende a mejorar la distribución:

1. Una distancia corta produce un haz de rápida expansión, acorta la duración de los tratamientos y aminora el peligro de lesionar la vejiga, el recto y los intestinos con un porcentaje demasiado alto de dosis profunda.

2. Un campo rectangular o un campo agregado permite llevar una dosis más adecuada a los fórnices laterales de la vagina y amengua el peligro de que sobrevengan cistitis y proctitis.

3. El empleo de rayos poco filtrados o sin filtrar acorta los tratamientos e impide la administración de un porcentaje demasiado alto de dosis profunda.

4. Los campos múltiples aseguran la administración de una dosis adecuada a los fórnices laterales y tienden a uniformizar la dosis profunda en un campo agregado grande.

Results of Radiation Therapy in Vascular Anomalies of the Central Nervous System[1]

GUSTAVE KAPLAN, M.D., BERNARD ROSWIT, M.D., and ERICH G. KRUEGER, M.D.
Bronx, N. Y.

THERE ARE FEW published studies in the English and American literature (2, 4, 5, 7, 9, 12, 13, 17) reporting the use of irradiation as primary form of treatment or as an adjunct to surgery in the management of vascular anomalies of the central nervous system. In most of the cases reported, a critical evaluation of the contribution of radiation was not possible. Descriptions of treatment factors were either omitted or inadequately recorded. The purpose of this report is to present an evaluation of our own experience in the use of roentgen therapy as an adjunct to surgery in the treatment of these pathologic entities, which are responsible for such distressing and disabling symptoms as headaches, vomiting, vertigo, epilepsy, hemiplegia, and impotence.

The vast majority of these lesions cannot be completely extirpated by surgery. In most instances only surgical decompression is possible. Postoperative roentgen therapy was therefore employed in an attempt to induce an endarteritis, diminishing the size of the lesion and possibly even obliterating it. It was hoped that, in some instances, complete extirpation by surgery might become possible after irradiation.

At the present time, it is generally agreed that the vascular lesions under consideration are not tumors but are congenital malformations. Cushing and Bailey (2) divide them into three categories: (*a*) telangiectases, (*b*) venous angiomas, (*c*) arterial or arteriovenous angiomas. These authors favored the view that "the lesions are essentially anomalies, and even though they may be capable of growth, they are in no sense comparable to the true neoplastic tumors of the hemangioblastic variety." Willis (16) stated that angiomas are not true tumors but malformations or hamartomas in which the various tissues of a part are present in improper proportions or distributed with prominent excess of one particular tissue.

Our study is based upon 9 cases, 5 with cerebral localization and 4 in the spinal cord. The lesions were distributed as follows: frontal, 1 (Case 4); temporal, 1 (Case 2); frontoparietal, 2 (Cases 3 and 5); parietal, 1 (Case 1); conus medullaris, 2 (Cases 6 and 8); dorsal, 2 (Cases 7 and 9).

At operation, 4 of the 5 brain lesions were observed to have venous as well as arterial components and would therefore fall in the third category of the classification proposed by Cushing and Bailey. The fifth brain case was diagnosed by means of cerebral angiography. All of the 4 spinal cord cases were found at surgery to be varices. No biopsies were performed because of the obvious danger of uncontrollable hemorrhage.

Therapy: Surgical therapy consisted of decompression alone in 7 cases, ligation of the common carotid alone in 1 case, and decompression followed by ligation of the common cartoid artery at a subsequent date in another.

Roentgen therapy was given postoperatively in every instance. The quality of radiation ranged from h.v.l. 0.9 mm. Cu (200 kv., 0.5 mm. Cu filter) to h.v.l. 4.0 mm. Cu (400 kv., Thoraeus filter). The depth dose varied from 700 to 2,400 r, and the over-all period during which treatment was given from six to twenty-eight

[1] From the Departments of Radiotherapy (G. K. and B. R.) and Neurosurgery (E. G. K.), Veterans Administration Hospital, Bronx, New York. Accepted for publication in January 1952.
Reviewed in the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the authors are the result of their own study and do not necessarily reflect the opinion or policy of the Veterans Administration.

TABLE I: RESULTS OF TREATMENT IN NINE CASES OF VASCULAR ANOMALIES OF THE CENTRAL NERVOUS SYSTEM

Case No., Lesion, and Location	Symptoms	Surgical Treatment	Postoperative Status	Radiotherapy Tissue Dose and Treatment Time	Observation Period in Months	Post-irradiation Status
1. Arteriovenous Rt. parietal	Epilepsy, headaches, vomiting	Decompression	General clinical improvement	1,180 r, 22 days	40	Headaches, vomiting
2. Arteriovenous Temporal	Headaches, dizzy spells	Ligation of the common carotid	Unchanged	1,290 r, 23 days	24	Unchanged
3. Arteriovenous Frontoparietal	Hemiplegia, headaches	Decompression	Decreased headaches; return of strength to upper and lower extremities	1,800 r, 14 days	24	No improvement. Head aches, left side weakness, severe difficulty in walking
4. Arteriovenous Frontal	Nervousness and hemiplegia	Decompression	Moderate improvement	1,900 r, 28 days	16	No improvement. Confusion, disorientation, epileptic seizures, dizziness
5. Arteriovenous Frontoparietal	Epileptic seizures	1. Decompression	Improvement	2,326 r, 20 days	9	No improvement
	Epileptic seizures and headaches; increasing weakness	2. Ligation of common carotid	Moderate improvement	... ...	13	Improvement
6. Varices Conus medullaris	Weakness of lower extremities, difficulty in walking	Decompression	No improvement	1,000 r, 6 days 690 r, 10 days	2 14	No improvement No improvement
7. Varices Dorsal	Paralysis of right leg, incontinence, back pain, impotence	Decompression	Marked improvement	770 r, 5 days	24	No further improvement
8. Varices Conus medullaris	Weakness of lower extremities	Decompression	Minimal improvement for a month	1,820 r, 27 days 1,300 r, 27 days	6 15	No improvement No improvement
9. Varices Lower dorsal	Weakness, of left leg, urinary retention	Decompression	No improvement	1,000 r, 14 days	20	No improvement

days. Only 2 cases received a second course of x-ray therapy (Cases 6 and 8). Follow-up periods ranged from two months to forty months.

Results (Table I): Following surgical decompression alone, moderate to marked clinical improvement was noted in 5 patients (Cases 1, 3, 4, 5, 7); minimal improvement in 1 patient (Case 8), and no improvement in 2 patients (Cases 6 and 9). Ligation of the common carotid resulted in failure in one instance (Case 2) and moderate improvement in another (Case 5). It is to be noted that x-ray therapy not only failed to maintain improvement resulting from surgery, but also failed to bring about improvement when surgery was of no benefit. Only 1 patient (Case 7) maintained his postoperative improvement for two years following a relatively small tissue dose (770 r in five days).

DISCUSSION

The management of vascular anomalies of the central nervous system has rested

principally upon surgery, surgery and irradiation, and irradiation alone. The surgical procedures employed in most clinics include decompression, ligation of the common carotid, tying off the afferent blood vessels, electrocoagulation, excision of the vascular mass.

It is beyond the scope of this paper to discuss the surgical aspects of this problem. Instead we shall evaluate the role of roentgen radiation as an adjunct or as an independent therapeutic agent on the basis of our experience and available experimental data.

Pennybacker and Russell (8) favor the view that the primary effect of radiation is on the smaller blood vessels. In a report on 9 cases of brain necrosis which they ascribe to irradiation, they state as their opinion that the pathology of brain necrosis appears to be related to the action of the smaller blood vessels. Russell, Wilson and Tansley (11) produced radionecrosis of the brain in rabbits and confirmed the findings of Pennybacker and Russell in man.

In a personal communication, Russell (10) related her experience with 2 cases of vascular anomalies receiving x-ray therapy. In 1 case, irradiation was given three years before the patient died as the result of a surgical attempt to remove the angiomatous mass. The histologic appearance indicated some focal irradiation necrosis of brain tissue in the region of the abnormal vessels, but there was no evidence that the vessels themselves were altered. In the other case, x-ray therapy was used nine years before death, and again there appeared to be no evidence that the blood vessels were affected.

Davidoff *et al.* (3) irradiated directly the brain and spinal cord in a series of monkeys. The effect of radiation was noted by these observers to be primarily upon the parenchyma of the brain rather than upon the blood vessels. Connective-tissue thickening of blood vessels did occur, but it was not sufficiently marked to account for the severe parenchymatous degeneration. Irradiation produced mainly parenchymatous degeneration, both nerve and glial cells being profoundly affected. The changes in the blood vessels were slight indeed.

Lyman *et al.* (6) irradiated 4 adult dogs with heavy doses of roentgen rays to the occipital part of the brain and noted diffusely scattered degenerative changes in the precapillaries and capillaries of the brain six weeks after irradiation. In one dog which was allowed to live six months after irradiation, autopsy revealed changes in the arterioles—hyalin degeneration and obliterative sclerosis.

Shields Warren (15) feels that "the crux of the results of irradiation of vascular malformations lies in the caliber of the vessels irradiated. If these vessels are of capillary or arteriolar type predominantly, good results will be obtained in the range of 1,000-1,200 r delivered to the tumor. If, on the other hand, the vessels are of large caliber, there will be no satisfactory response even with much greater doses. Unfortunately, the predominant type of vascular malformation is of fairly large vessel caliber."

Carpender (1) likewise feels that, in order to affect these large blood vessels, a quantity of radiation must be given which will irreparably damage the normal tissue. Consequently, he does not treat them.

Wachowski and Chenault (14) published a report of 6 cases of brain necrosis following irradiation, 3 of which came to autopsy. These showed extensive degenerative changes in the nerve tissue. The doses delivered were 7,758 r in one hundred and five days; 8,910 r in eighty-four days, and 8,809 r in eighty-seven days. "One striking feature was the invariably good state of preservation of the larger blood vessels."

None of our patients treated with roentgen therapy received any apparent clinical benefit. It must be emphasized that these vascular lesions were anomalies and not true tumors. The vessels were large, well developed and mature. They were situated in inaccessible areas amid nervous tissue which is highly radioresistant. A differential response to irradiation between

tumor and normal tissue did not exist. Thus, our results were not inconsistent with experimental and clinical data furnished by others.

SUMMARY AND CONCLUSIONS

Our experience with roentgen therapy of cerebral and spinal vascular anomalies, though limited, suggests that radiation has no role in the management of these lesions. This opinion is supported by ample clinical and experimental evidence presented by others.

130 W. Kingsbridge Rd.
Bronx 68, N. Y.

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SUMARIO

Los Resultados de la Radioterapia en las Anomalías Vasculares del Sistema Nervioso Central

La roentgenoterapia fué ensayada en 9 casos de anomalías vasculares del sistema nervioso central, tratados antes con la descompresión o con la ligadura de la caródida primitiva o en ambas formas. En ningún caso obtúvose beneficio clínico con la irradiación. Hácese notar que esas lesiones vasculares eran anomalías y no verdaderos tumores. Los vasos eran grandes y maduros, estando bien desarrollados y hallándose situados en zonas inaccesibles en medio de tejido nervioso que es por demás radiorresistente.

Estos resultados concuerdan con las observaciones clínicas y experimentales de otros técnicos.

Synergistic Action of Cortisone and Total-Body Irradiation in Mice

JOHN H. WENTWORTH, M.D., and JOHN A. BILLOWS, M.D.

Brooklyn, N. Y.

LABORATORY evidence has indicated that at least part of the biological action of ionizing radiations is due to inhibition of sulfhydryl obligate intracellular enzyme systems by oxidation of the sulfhydryl radical, *e.g.*, cysteine to cystine (1, 2). The protective action against lethal total-body irradiation offered by sulfhydryl donors such as cysteine and glutathione is further evidence of the importance of this mechanism (3, 4). Similarly, substances which temporarily inhibit oxidation of sulfhydryl (—SH) provide significant protection against lethal irradiation. Cyanide, azide, and malononitrile (5), and anoxic anoxia (6) are examples.

Cortisone and ACTH have recently been shown also to inhibit the sulfhydryl obligate systems as part of their fundamental biological action (7, 8). Therefore, some synergistic action of these drugs and irradiation could logically be expected. On the other hand, attempts have been made to demonstrate their value as *protective* agents against whole-body irradiation—one being reported as successful (9) and another as unsuccessful (10). The present report concerns an investigation into what seemed to us to be a more logical possibility, namely, a synergistic action between cortisone and whole-body irradiation.

METHOD

As test animals white male mice of a single inbred strain were used. To provide further uniformity they were fed and observed for ten days, reaching a fairly uniform weight of 25 gm. They were then divided at random into four groups of 12 mice each for the initial experiment. One group received a single dose of 220-kv. roentgen irradiation amounting to 750 r, including back-scatter, estimated to be at least and probably more than an LD 50 dose. A second group was irradiated in the same way after being given 1 mg. of cortisone subcutaneously twenty-four and twelve hours previously. The third group also received 750 r, but the cortisone was given in daily injections of 1.0 mg. following the irradiation. The animals of the fourth group served as controls, given cortisone daily only as long as there were survivors in the third group.

This initial experiment was more or less exploratory, to determine gross effects and investigate protection *or* synergism with different timing. The results are summarized in Figure 2. On the basis of these observations, discussed below, another experiment was set up with dosages and timing selected with a view to proving more conclusively the apparent synergism initially observed.

For the second experiment the same kind of mice and the same treatment conditions were used. Three groups of 12, 13, and 13 mice, respectively, were again selected at random after an initial period of feeding and observation. The first received a single dose of 400 r, the second two injections of 3 mg. of cortisone five hours apart, and the third 400 r irradiation after administration of 3 mg. of cortisone nine hours and four hours before.

Irradiation was given with a conventional deep therapy unit at 220 kv., with 0.5 mm. Cu filtration (h.v.l. 1 mm. Cu). The mice were held loosely in individual chambers, as shown in Figure 1. Duplicating the positions of the mice with the chamber as nearly as possible, variations in dosage in the field were shown with a Victoreen r-meter to be ±7 per cent.

[1] From the Department of Radiology, Brooklyn Hospital, Brooklyn, N. Y. Accepted for publication in January 1952.

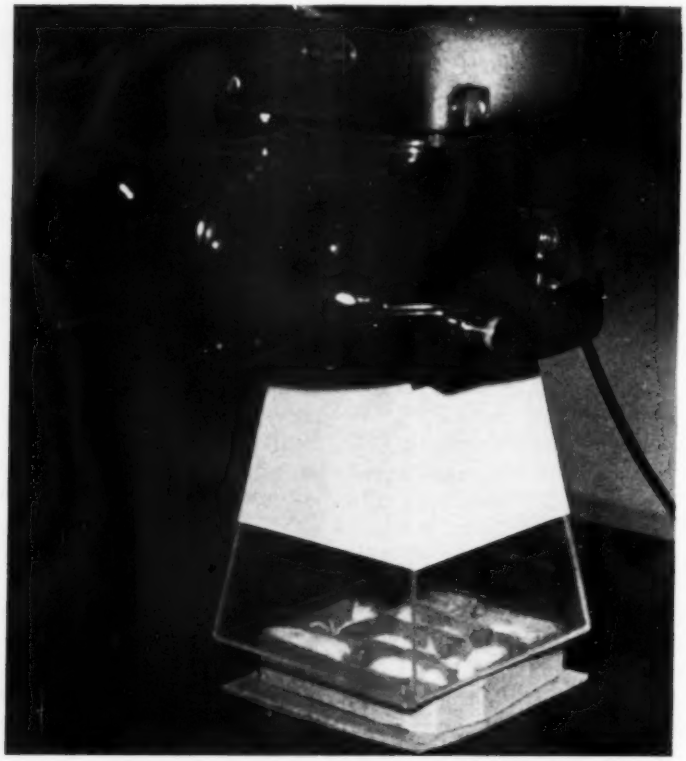

Fig. 1. Method of total body irradiation of mice.

The cortisone was prepared fresh for each set of injections by diluting the standard 25 mg. per c.c. solution with normal saline, to 1 mg. per cubic centimeter for the 1 mg. injections and to half strength for the 3 mg. injections. All injections were given subcutaneously in the inner aspect of the thigh.

RESULTS

Figure 2 summarizes the results in the first four groups of mice. Not only did the cortisone fail to offer any protection against lethal radiation effects, but appeared to hasten death. Since the 750 r proved 100 per cent lethal alone and 50 per cent of the cortisone group died for one reason or another, no clear-cut conclusions could be drawn.

For a clearer analysis of the apparent synergism it was decided to combine the cortisone administration and irradiation in such a manner that their maximal effects would coincide as nearly as possible and to reduce the dose of x-rays below the estimated LD 50. Also the cortisone dosage was increased to two 3 mg. injections when this amount was found to be well tolerated by a few test animals. The two control groups receiving the 400 r and the 6 mg. of cortisone all survived and are still living and well approximately two months later. For the usual period, the common irradiation effects of hair loss, diarrhea, and listlessness were observed in the irradiated mice, and the cortisone animals temporarily exhibited considerable overactivity. The group of 13 mice receiving both irradiation and cortisone showed much more severe general physical debility and secondary radiation effects; 7 were dead at the end of a week, and 2 more by the eleventh day. The 4 survivors gradually returned to normal and are still alive

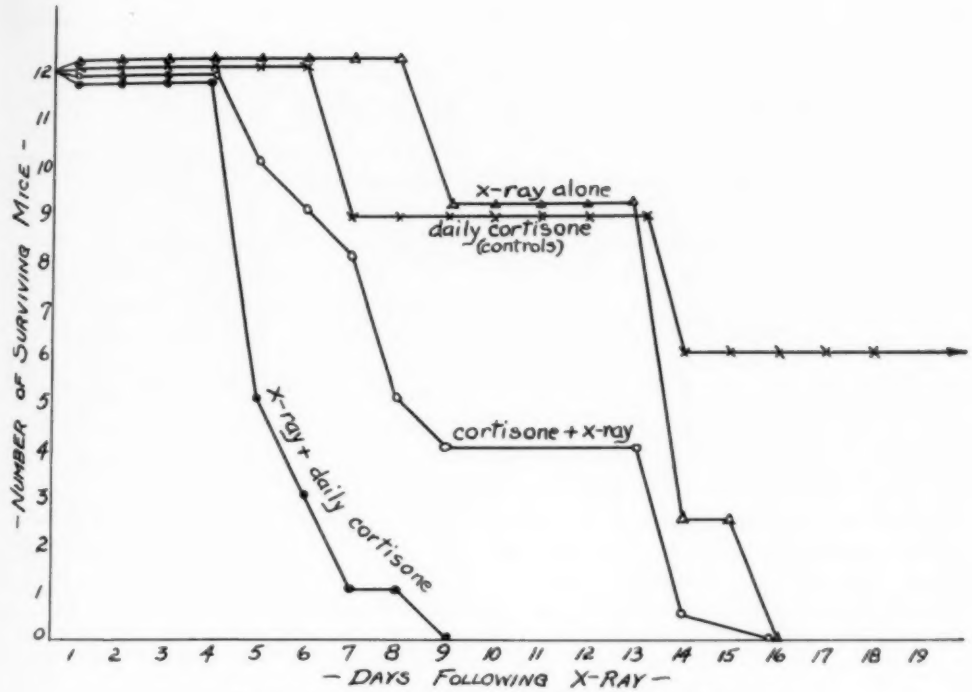

Fig. 2. Survival curves for the first four groups of mice.

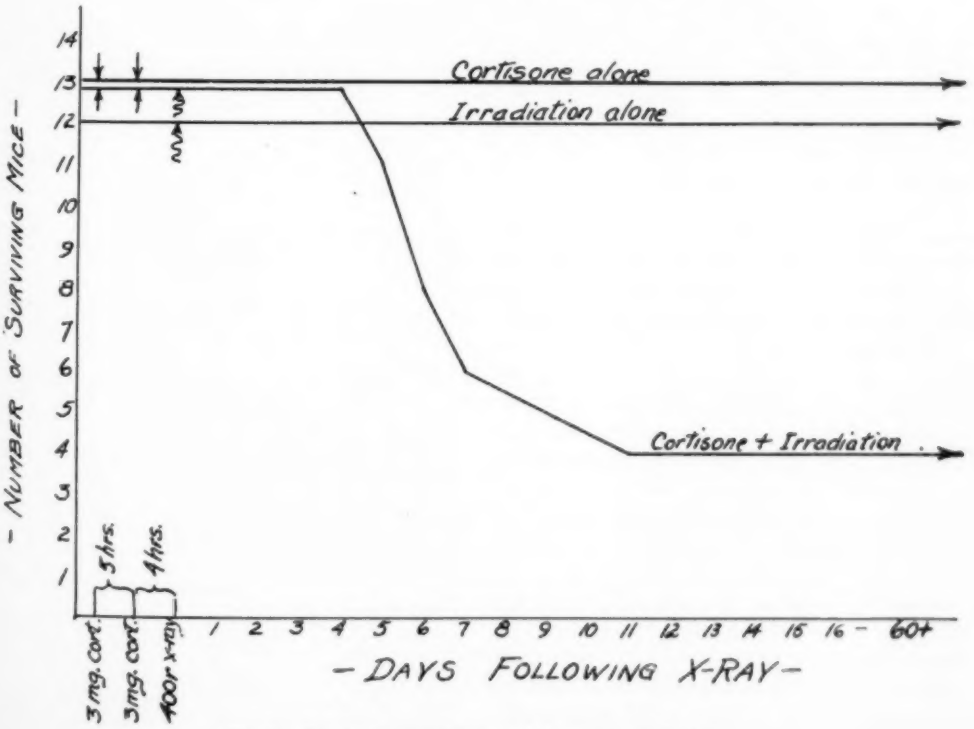

Fig. 3. Survival curves for second three groups of mice.

two months later. Figure 3 summarizes these results for comparison with Figure 2.

Since sulfhydryl donors, such as cysteine and glutathione, have proved effective as protective agents against otherwise lethal irradiation, these agents were tried in an attempt to reverse the lethal synergistic effect of combined cortisone and irradiation. One hour prior to irradiation with 400 r and after the two 3 mg. injections of cortisone, 12 mice were injected with 20 mg. of freshly prepared buffered cysteine. No protection was offered; in fact, death was hastened, all of the animals being dead by the end of a week. Similarly, with 40 mg. of glutathione all of 14 mice were dead within eleven days, as compared to 11 of 15 without glutathione, death occurring with about the same rapidity in the two groups. A small repeat group receiving 20 mg. of glutathione showed approximately the same result.

DISCUSSION

In the first groups of mice receiving lethal doses of radiation there is a definite lack of any evidence favoring a protective effect of cortisone. In view of the heavy dosage and the small number of mice used, no further definite conclusions seem warranted. However, in the second three groups the difference between 100 per cent survival in the cortisone and the irradiation control groups and the survival of only 31 per cent of the animals treated by both agents is significant and striking, indicating a synergistic activity of the two agents given so that their presumed depression of the sulfhydryl obligate systems would appear to be simultaneous. The oxidation of —SH, known to be caused by both agents, is therefore advanced as the probable basic biological mechanism responsible for this demonstrated synergistic activity. The failure of reversal by —SH donors is puzzling, and is to be pursued further. Unrelated toxic effects of parenteral administration added to otherwise sublethal radiation debility might be responsible, and controlled oral administration should be tried.

If further studies show the above synergism to extend to other radiation effects, the clinical implications respecting dangers of and therapeutic use of these combined measures are obvious.

SUMMARY

A report is presented of the results of joint administration of cortisone and whole-body irradiation in a small series of mice. A lethal synergistic effect was demonstrated. Inhibition of sulfhydryl obligate intracellular enzyme systems by inactivation of the sulfhydryl radical is suggested as a common basic mechanism.

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The Brooklyn Hospital
DeKalb Ave. and Ashland Place
Brooklyn 1, N. Y.

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SUMARIO

Acción Sinérgica de la Cortisona y de la Irradiación Total del Cuerpo en los Ratones

A fin de determinar si la cortisona y la irradiación total del cuerpo ejercen efecto sinérgico, los AA. llevaron a cabo experimentos en ratones. Una serie de animales no recibió más que cortisona; otra serie recibió 400 r de irradiación roentgen aplicada a todo el cuerpo, en tanto que la tercera serie recibió cortisona a la vez que irradiación, administradas de modo que coincidieran sus efectos máximos.

Todos los animales de los primeros dos grupos sobrevivieron, en tanto que 7 del tercer grupo de 13 animales murieron en término de una semana y 2 más para el undécimo día.

Opinan los AA. que queda así establecido el efecto sinérgico de la administración conjunta de cortisona y de la irradiación total del cuerpo. Sugiérese que el mecanismo básico en común es la inhibición de sulfhidrilo obligado en los sistemas intracelulares de encimas por la inactivación del sulfhidrilo radical.

Si nuevos estudios demuestran que la sinergia mencionada se extiende a otros efectos de la irradiación, quedan de manifiesto las indicaciones clínicas derivadas del peligro que entraña el uso terapéutico de dichas medidas combinadas.

Synergistic Lethal Action of Certain Radioisotopes in Rats[1]

PAUL R. SALERNO, Ph.D., H. L. FRIEDELL, M.D., JAMES H. CHRISTIE, M.D., and MARVIN BERG
Cleveland, Ohio

As is well known, one of the primary factors which determines the nature of the acute toxicity of an internally administered radioactive isotope is its pattern of distribution in the body. For example, the toxicity of P^{32} in rats is significantly less in the form of colloidal $CrPO_4$ than in the form of ionic Na_2HPO_4. By using two separate isotopes having widely different distributions, it is possible to study the interrelationship of various systems in the body as well as to elucidate the dependence of survival of the whole organism upon the injury of specific organ systems.

Previous studies in this laboratory have shown that a combination of colloidal Au^{198} and P^{32} administered to rats is more lethal than either agent administered singly (1). These experiments have been extended to determine whether synergistic lethal action occurs with other internal emitters when these are used in combination.

MATERIAL AND METHODS

P^{32}, obtained from the U. S. Atomic Energy Commission, Oak Ridge, Tenn., was used as Na_2HPO_4 and in the preparation of colloidal chromic phosphate. The preparation of this colloid was according to the method of Jones, Wrobel and Lyons (2) and is described in detail in a previous report (3). $Sr^{89, 90}$ was also obtained from the above source and was incorporated into colloidal $Sr_3(PO_4)_2$ following the procedure of DeToni (4). Colloidal Au^{198} was obtained from Abbott Laboratories, North Chicago, Ill. The colloidal preparations were injected intravenously into either lateral tail vein of the rat after the animal had been immobilized in a wire cage and the tail washed in tepid water. Volumes of less than 0.5 c.c. were slowly injected with a 26-gauge needle. The incidence of faulty injections was less than 10 per cent, and such animals were immediately discarded from the experiment. Na_2HPO_4 was always injected intraperitoneally. Other details of procedure were as reported in a previous communication (1).

In order to establish reference data for the investigation of the lethal action of two radioisotopes administered simultaneously, determinations were made of the approximate 30-day LD 50 values of each agent. Radiation dosages of all isotopes were on a microcurie per gram of rat basis. The validity of this procedure has been established in this laboratory (3). At least 100 animals were used in each LD 50 determination. The dosage-mortality data are plotted on logarithmic probability paper in Figure 1.

Although each isotope was standardized in our laboratory and agreement with other assays was within 5 per cent, the colloidal preparations sometimes deviated significantly from the anticipated lethal potency. This variable was controlled by concomitant testing of each isotope singly with each combination experiment. The animals in each separate experiment were restricted to a single shipment from Carworth Farms of stock male albino rats of the Wistar strain. The average weight of the rats was approximately 160 grams. The final criterion of the validity of the synergistic action was the ability to reproduce this specific type of combined action at several dosage levels.

A comparison of the relative distribution of each of the isotopes employed is presented in Figure 2. Complete distribution studies of twenty-one different tissues at intervals of one hour to fourteen days

[1] From the Department of Radiology, Western Reserve University, Cleveland, Ohio. Work performed under contract No. W31-109-eng-78 between the U. S. Atomic Energy Commission and Western Reserve University. Accepted for publication in February 1952.

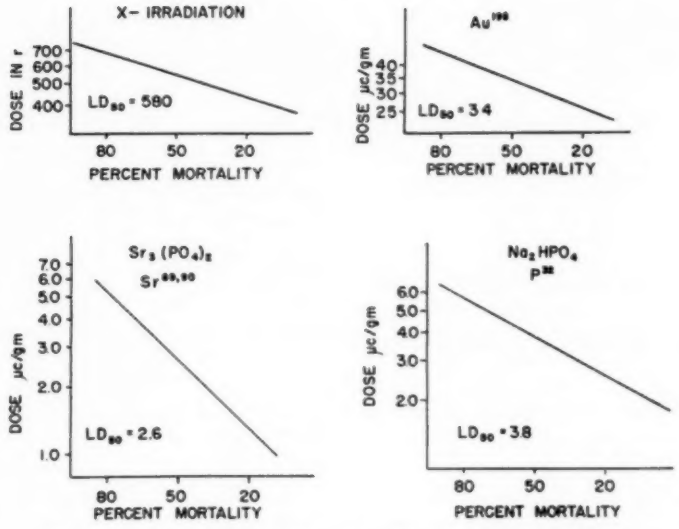

Fig. 1. Dose mortality plots in male albino rats (log probability).

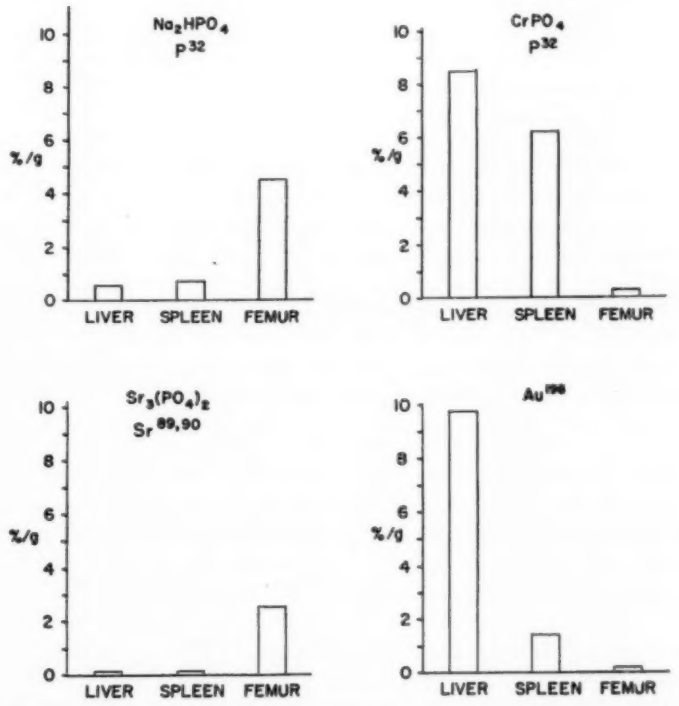

Fig. 2. Distribution of isotope expressed as per cent of injected dose per gram of tissue. Determinations on third day following injection.

TABLE I: SYNERGISTIC LETHAL ACTION OF Au^{198} IN COMBINATION WITH $Sr^{89, 90}$ OR P^{32} IN RATS

Radioisotope Dosage in μc/gm.	No. of Animals	Actual Mortality (per cent)	Expected Mortality† (per cent)
Au,* 22	20	0	...
$Sr_3*(PO_4)_2$, 1.6	20	35	...
Au*, 11; $Sr_3*(PO_4)_2$, 0.8	20	85	18
Au*, 26	15	40	...
$Sr_3*(PO_4)_2$, 2	15	40	...
Au*, 13; $Sr_3*(PO_4)_2$, 1	15	87	40
Au,* 30	12	8	...
Na_2HP*O_4, 3.3	12	25	...
Au*, 15; Na_2HP*O_4, 1.65	12	92	17

* Radioactive isotope.
† Approximated on the basis of simple summation in combined action.

following injection are presented in previous reports from this laboratory (3, 5, 6). The retentions in the liver, spleen, and femur at three days furnish a useful and representative index of the major distribution. In the case of colloidal gold or chromic phosphate, the pattern of distribution after one hour and fourteen days remains essentially unaltered. However, since colloidal strontium phosphate is not a stable colloid, the concentration of this material in the liver and spleen decreases from 5.0–6.0 per cent of the injected dose per gram at one hour to 0.1–0.2 per cent of the injected dose per gram of tissue at twenty-four hours post-injection. Approximately 20 per cent of the injected strontium is excreted within twenty-four hours, during which time the concentration in the femur rises from 1.56 to 2.51 per cent of the injected dose per gram. The pattern of distribution then remains rather constant after the first day and is as shown in Figure 2.

As indicated in a preliminary report (1), the sharp contrast between the fate of colloidal Au and $Sr_3(PO_4)_2$ suggested an investigation of their combined lethal action. The phenomenon of synergistic lethal action found with Au^{198} and P^{32} (7) was demonstrated again with Au^{198} and $Sr^{89, 90}$. It may be noted in Table I that the synergy is of comparable magnitude in both cases. In all combination studies the dosages employed were one-half of the dose of each isotope used singly as controls. The slopes of the dosage-mortality curves are such that the one-half dosages used would result in an insignificant mortality by independent action.

Since P^{32} as Na_2HPO_4 and $Sr^{89, 90}$ as $Sr_3(PO_4)_2$ are similar in two respects, namely, in distribution and in exhibiting synergistic lethal action when administered in combination with Au^{198}, it was anticipated that these two agents would not be synergistic between themselves. Table II contains data which indicate the simple additivity produced by this combination.

TABLE II: ADDITIVE LETHAL ACTION OF $Sr^{89, 90}$ AND P^{32} IN RATS

Radioisotope Dosage in μc/gm.	No. of Animals	Actual Mortality (per cent)	Expected Mortality† (per cent)
$Sr_3*(PO_4)_2$, 1.6	16	19	...
Na_2HP*O_4, 2.6	16	0	...
$Sr_3*(PO_4)_2$, 0.8; Na_2HP*O_4, 1.3	16	19	10
$Sr_3*(PO_4)_2$, 3.8	16	69	...
Na_2HP*O_4, 4.4	16	63	...
$Sr_3*(PO_4)_2$, 1.9; Na_2HP*O_4, 2.2	16	50	66

* Radioactive isotope.
† Approximated on the basis of simple summation in combined action.

The lack of synergism between $Sr^{89, 90}$ and P^{32} suggests that the toxicity of internal emitters administered in combination may be predicted following the principles of combined drug action. That is, if two toxic agents act in a similar manner on the same organ system, their combined effectiveness as manifested in lethality is the result of an algebraic addition of the two like components producing tissue injury. On the other hand, if two toxic agents injure different organ systems, simple addition is very unlikely. To further test this premise, it was felt desirable to investigate the combined action of Au^{198} and $CrP^{32}O_4$, two colloids of very similar distribution to the reticuloendothelial system (Fig. 2). The lack of synergism in this combination may be observed in Table III.

To further substantiate the hypothesis of selective organ system injury as the determinant in synergistic lethal action, experiments were conducted to compare the effectiveness of the combination of x-irradiation plus P^{32} and x-irradiation plus

TABLE III. ADDITIVE LETHAL ACTION OF Au^{198} AND $CrP^{32}O_4$ ADMINISTERED IN COMBINATION TO RATS

Radioisotope Dosage in μc/gm.	No. of Animals	Actual Mortality (per cent)	Expected Mortality† (per cent)
Au,* 28	40	18	...
CrP^*O_4, 4.5	40	15	...
Au*, 14; CrP^*O_4, 2.25	40	25	17

* Radioactive isotope.
† Approximated on the basis of simple summation in combined action.

Au^{198}. The similarity between P^{32} and x-rays in producing hematopoietic depression has been amply demonstrated in radiobiology and in the clinical application of these two agents. Since Au^{198} and P^{32} differ in the nature of their acute toxicity, the type of combined lethal action observed when each is combined with x-irradiation should be different. Table IV contains data which demonstrate that P^{32} is additive or less and that Au^{198} is definitely synergistic when combined with x-irradiation.

TABLE IV: P^{32} NEGATIVE AND Au^{198} POSITIVE IN PRODUCING SYNERGISTIC LETHAL ACTION IN COMBINATION WITH X-IRRADIATION

Radioisotope Dosage in μc/gm. or r	No. of Animals	Actual Mortality (per cent)	Expected Mortality† (per cent)
X-rays, 520 r	16	44	...
$Na_2HP^*O_4$, 2.6	16	25	...
260 r; $Na_2HP^*O_4$, 1.3	16	13	35
X-rays, 520 r	16	38	...
Au*, 28	16	13	...
260 r; Au*,14	16	69	26

* Radioactive isotope.
† Approximated on the basis of simple summation in combined action.

Further experiments utilizing colloidal chromic phosphate were limited to preliminary testing, since Abbott Laboratories have sent us a sample of this colloid which by virtue of its stable uniformity and ease of handling is much more satisfactory than our preparation. These studies are in progress, and the observation that P^{32}-labeled Na_2HPO_4 and P^{32}-labeled $CrPO_4$ are definitely synergistic should be mentioned at this time. This finding removes any uncertainty of interpretation due to different radiation characteristics and half-lives.

The rationale of the method of halving two definitive doses of radiation to test

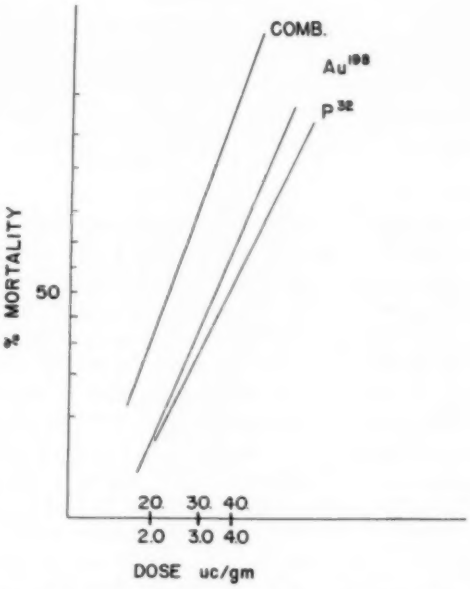

Fig. 3. Synergistic lethal action of Au^{198} and P^{32} in rats (log probability).

combined toxicity has been discussed in an earlier paper (1).[2] However, it was considered worth while to analyze further the enhanced lethality of Au^{198} plus P^{32}. Three dosage levels were selected which could be plotted graphically to yield a straight line on logarithmic probability paper. One-half of the LD 50 dose of P^{32} plus one-half of the LD 50 dose of Au^{198}, 80 per cent of each of these doses, and 60 per cent of each of these doses, were given, respectively, to three groups of 20 rats each. Since the slope of the LD 50 curve for P^{32} is similar to that of Au^{198}, the expected mortality on the basis of additive action would have been 50, 25–30, and 0 per cent. The actual mortality data were 95, 75, and 45 per cent. Thus, a definite and consistent synergism of 45 to 50 per cent in-

[2] The method of testing additivity or synergism has been previously described. It may be stated simply as follows: if one-half of a definitive dose of radiation A and one-half of a definitive dose of radiation B are combined, the effect obtained should approximate an average of the effects of definitive doses A and B used singly if there is simple additivity. If a potentiating effect is present, the number of animals killed will be greater than that theoretically expected, and the action is said to be synergistic.

crease in mortality was observed. In terms of dosage, less than 65 per cent of the one-half LD 50 values of each isotope given in combination kills 50 per cent of the animals. These data are plotted in Figure 3.

DISCUSSION

The constant finding that simultaneous radiation injury to the reticuloendothelial system and the bone marrow results in synergistic lethal action further indicates a role of the reticuloendothelial system in the survival of the organism following exposure to radiation in the lethal range. Although Jacobson has shown that shielding of liver tissue confers some protection against x-ray-induced mortality (7), the enhanced survival afforded by spleen shielding appeared to be much more significant, especially in view of the small size of the shielded area compared to total body mass. Experiments evaluating the role of the spleen and liver in synergistic lethal action are in progress and will be the subject of a later report. The spleen is severely damaged by colloidal Au^{198}. Preliminary experiments have revealed that Au^{198}-induced hematopoietic depression and death are not intensified by splenectomy, presumably because the effects of Au^{198} on the spleen are tantamount to its removal. These studies are being extended to include the influence of splenectomy on survival following irradiation by other internal emitters and x-irradiation both singly and in combination.

The mechanism by which the spleen may enhance the recovery of injured bone marrow has not been elucidated. It may be concluded, however, that the final effects of an initial depletion of the cellular constituents of the hematopoietic system may be either intensified or reduced depending upon the integrity of the reticuloendothelial tissue in general and the spleen in particular. The spleen appears to buffer the bone marrow, thus affording a secondary line of defense against the severe hematopoietic depression resulting from radiation. The selective and severe damage produced by a suitable radioactive colloid thus removes this important sparing action of the spleen. Experiments designed to assay radiation-induced liver injury and its effect on blood-forming tissues are in progress. Some information on the interdependence of organ systems in resisting or succumbing to radiation-induced lethality would thus be acquired.

SUMMARY

Synergistic lethal action (combined action greater than simple summation) has been clearly established with a number of internally distributed radioactive isotopes. The synergism appears to be a function of the simultaneous radiation injury of two separate systems. It would appear that the reticuloendothelial system and the hematopoietic systems are closely related and the effects are much more profound when both are injured then when the injury is confined to either one. An attempt to clarify the relationship between these two systems will be made by further experiments. It is to be noted that when two different isotopes are restricted to the same organ system by virtue of their distribution, the effects appear to be due to simple summation.

Department of Radiology
Western Reserve University
Cleveland 6, Ohio

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SUMARIO

La Acción Letal Sinérgica de Ciertos Radioisotopos en las Ratas

Ya está netamente establecida la acción local sinérgica (acción combinada mayor que la suma de la de los componentes) ejercida por varios isotopos radioactivos distribuídos internamente. La sinergia parece ser una función de la lesión irradiatoria simultánea de dos distintos sistemas o aparatos. Al parecer, el aparato reticuloendotelial y el aparato hematopoyético son íntimamente afines y los efectos son mucho más profundos cuando ambos se ven lesionados que cuando la lesión se limita a uno u otro. Va a tratarse de esclarecer la relación que existe entre ambos aparatos con nuevos experimentos. Obsérvese que, cuando se limita la acción de dos isotopos distintos al mismo aparato por virtud de su distribución, los efectos parecen ser de mera adición.

Nota: La técnica para comprobar si se trata de aditamento o de sinergia puede expresarse sencillamente en esta forma: si se combinan la mitad de una dosis definitiva de rayos A y la mitad de una dosis de rayos B, el efecto obtenido se aproximará al promedio de los efectos de dosis definitivas de A y B usadas por separado si existe mero aditamento. Si hay presente un efecto potenciador, el número de animales matados será mayor que el esperado teóricamente, y la acción será sinérgica.

Polyp of the Duodenal Bulb

Report of a Case[1]

RANDOLPH W. J. BORRON, M.D., LEONARD GOLDBERG, M.D., and CHARLES E. KNOWLTON, M.D.
Toronto, Ontario

ALTHOUGH THE duodenal cap is one of the most closely examined parts of the intestinal tract, it is rarely the site of lesions other than ulcer. The following study brings to 22 the number of benign adenomatous polyps in this location described in the literature.

CASE REPORT

Mrs. M. H., age seventy, was admitted to the hospital with right epigastric pain of six months duration. For the past twelve years she had complained of nausea and hunger pains relieved by eating. These symptoms resolved when treated with an ulcer diet and stomach powders. No roentgenograms were taken of the gastro-intestinal tract.

Fig. 1. Prone oblique view of barium-filled stomach and duodenum. A circular radiolucent area is seen in the central portion of the duodenal bulb.

In October 1950, the patient was involved in a car accident in which she received a blow to the right side of her abdomen, following which she experienced pain in the right upper quadrant. Because the pain persisted she went to her doctor, who obtained films of the ribs and a complete gastro-intestinal series.

Radiological Findings: On March 29, 1951, the esophagus, stomach, and duodenum were examined. The esophagus and stomach appeared normal. The duodenal cap filled out, with regular outlines, but showed a large central radiolucent filling defect occupying about one half of the volume of the cap. This defect was round and smooth but with no evidence of a pedicle. It could not be palpated, and its outline could not be obliterated by complete filling of the cap with barium (Figs. 1 and 2).

Fig. 2. Compression spot film of the duodenal bulb. Displacement of barium by the duodenal polyp is seen in detail.

On morphological grounds alone, a duodenal polyp was considered the most likely diagnosis, but the possibility of a gastric polyp which had prolapsed into the cap was kept in mind.

A repeat examination showed the same radiological changes, and attempts to push the presumed duodenal polyp into the stomach were unsuccessful. The diagnosis of duodenal polyp was therefore maintained.

Operative and Pathological Findings: The stomach and duodenum were exposed and a large polyp of the duodenum was palpated, which could be pushed into the stomach. The stomach was then opened near the pylorus and the polyp and pedicle were removed. The polyp measured 3.0 × 2.0 × 1.2 cm. with a pedicle about 2 cm. in length. The surface was nodular and pinkish gray in color.

Sections showed the polyp to be covered by a single layer of columnar cells, the majority of which

[1] From the Departments of Radiology (R.W.J.B. and L.G.) and Surgery (C.E.K.), St. Joseph's Hospital, Toronto, Ontario. Accepted for publication in January 1952.

were goblet cells. The crypts were somewhat irregular in outline and underlying them pale-staining glands could be seen, of the Bowman type. Sections through the base showed duodenal mucosa forming small villi which were covered by dark-staining columnar cells. There were numerous glands of the Bowman type, the majority of which were found beneath the muscularis mucosa (Fig. 3).

The pathologist's diagnosis was adenomatous polyp of the duodenum.

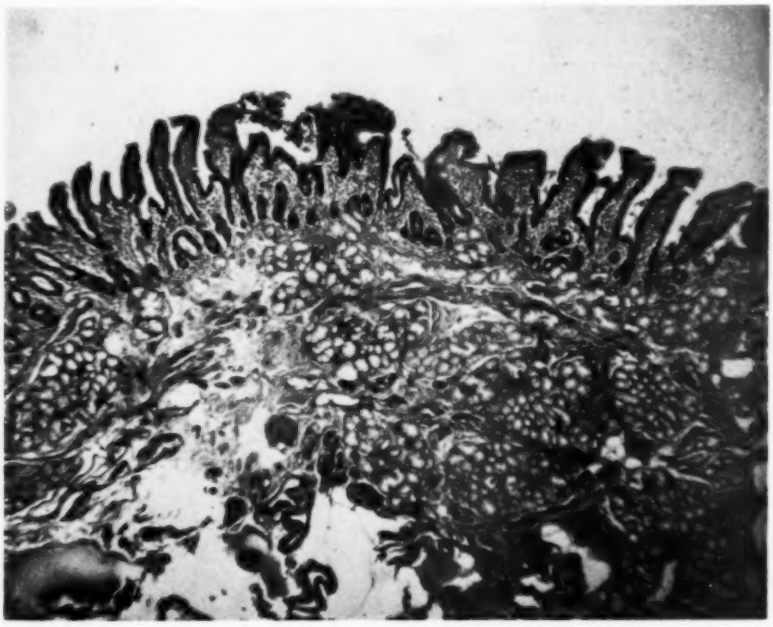

Fig. 3. Section of polyp (×150). The surface epithelium is well shown. Numerous mucous glands are seen below the surface.

DISCUSSION

Although a rare lesion, duodenal polyp resembles other gastro-intestinal polyps and the diagnosis should not be difficult from a radiological point of view. In the case recorded here, although a pedicle was present, it was not demonstrable on the film, being obscured by the main mass of the polyp.

The incidence of duodenal polyps is low. Willis (1) states that in his necropsy work he has not encountered any papillary or adenomatous polyps comparable with those of the stomach or large intestine. Golden (2), in a review of the literature dating from 1835, found 17 non-malignant tumors of the duodenum and added 2 cases of polyps of the duodenal cap. One was an adenoma of Brunner's gland, the other a polyp of mucous glands. Hoffman and Grayzel (3), in the most recent comprehensive review, listed 21 benign adenomas of the duodenum. These formed about one-third of all benign tumors at this site. These writers stated that the adenoma is the commonest benign duodenal tumor found and that it may be either of two types—the mucosal gland or the Brunner gland type.

Symptoms are difficult to assess. Doub (4), states that the pain is usually epigastric, though frequently it may be located in the right upper quadrant and may simulate gallbladder disease.

SUMMARY

A solitary polyp of the duodenal bulb in a seventy-year-old female is reported, bringing the total number of such polyps described in the literature to 22. The patient was operated on and made an uneventful recovery.

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St. Joseph's Hospital
Toronto, Ontario

SUMARIO

Pólipo del Bulbo Duodenal. Presentación de un Caso

Aunque el píleo ventricular es una de las porciones más escudriñadas del tubo intestinal, el descubrimiento de lesiones que no sean úlceras es extraño en dicho sitio. El caso de pólipo adenomatoso benigno aquí descrito es el vigésimosegundo comunicado hasta ahora con dicha localización.

El examen roentgenológico reveló un nicho radioluciente liso y redondo que indicaba pólipo duodenal, aunque se consideró la posibilidad de pólipo gástrico descendido. El diagnóstico de pólipo duodenal fué confirmado al operar. El enfermo se repuso sin contratiempo.

Gastroileostomy[1]

JOHN A. EVANS, M.D.
New York, N. Y.

THE RATHER unusual surgical error of gastroileostomy was first reported by Martin and Carroll (3) in 1915. Other case reports and discussions of the problem have been published by Rivers and Wilbur (7), Smith and Rivers (9), Brown *et al.* (2), and Moretz (5). The most recent reports are those of Polivy (6), Michels *et al.* (4), and Boice (1). Michels and his coworkers feel that with the recent enthusiasm for vagotomy and gastroenterostomy as a treatment for duodenal ulcer, more gastroileostomies are likely to result. While the history and symptoms in such cases may be suggestive, there is no constant, typical or pathognomonic clinical picture. Roentgenologic examination, however, is frequently diagnostic. Since the roentgen findings are usually specific, it is felt that the report of an additional case, with a discussion of some of the pertinent clinical and roentgen observations in this uncommon condition, is justified.

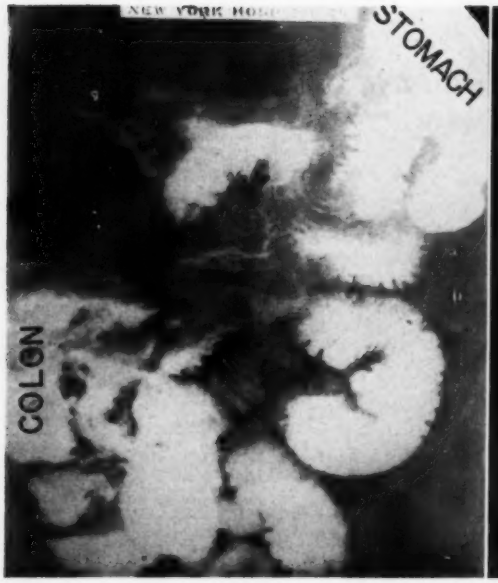
Symptoms include weight loss, diarrhea with the passage of undigested food in the stool, vomiting, hemorrhage, and severe pain if marginal or ileal ulceration is present. The type of surgery performed will influence the clinical picture. Gastroileostomy without gastric resection produces a much less severe group of symptoms than when gastric resection has been done. In the former condition, the pylorus may be patent, allowing most of the food to pass through the normal route. Furthermore, the severity of symptoms seems to be directly proportional to the amount of food passing through the gastroileostomy.

In the group of 6 cases reported by Michels *et al.* and in 26 cases from the literature reviewed by them, the most consistent finding was loss of weight. The nutritional status of the patient and the amount of weight loss were felt to depend less on the level of the anastomosis than on the relative amount of gastric chyme passing through the pylorus and through the gastroileal stoma. Pain, diarrhea, and vomiting were common symptoms, occurring in 21, 18, and 17 patients, respectively, in the combined group of 32. Iliac ulceration and hemorrhage were less common occurrences.

Brown *et al.* explain the symptoms on the basis of three mechanical factors. First, the diarrhea and malnutrition result from undigested food being rapidly passed into the ileum through a patent gastroileal stoma. Second, the stoma may be so located that, when the stomach is full, spasm about the stoma or kinking of the ileum may prevent any significant amount of food leaving the stomach through the gastroileostomy. The major portion of the food then passes into the small bowel by means of the normal pyloric route. Later some of the food may re-enter the stomach through the gastroileostomy stoma. Not only may this abnormal circuit produce nausea, vomiting, weight loss, and malnutrition, but it would also explain the fecal type of vomiting that has been reported in some cases. Third, part of the food may leave the stomach through each exit, with that portion which passes *via* the pylorus partly refilling the stomach some time later.

The syndrome most likely to be confused with gastroileostomy is gastrojejunocolic fistula. In the latter condition there is a definite interval of time before the development of jejunal ulceration, perforation into the colon, and onset of diarrhea; in gastroileostomy, diarrhea develops in the immediate postoperative period. A barium enema will usually demonstrate the fistu-

[1] From the Department of Radiology, New York Hospital-Cornell Medical Center, New York, N. Y. Accepted for publication in January 1952.



Figs. 1 and 2. Inspection of the spot films taken during examination of the upper gastrointestinal tract reveals what appears to be a subtotal gastric resection, a gastro-enterostomy, a few barium-filled loops of small bowel in the right lower abdominal quadrant, and barium in the cecum. During the fluoroscopic phase of the examination, barium left the stomach without delay through the gastro-enterostomy and, following transit through a few segments of small bowel, was suddenly observed in the cecum. The major portion of the small bowel is not demonstrated despite the fact that there is barium in the cecum and still a sizable quantity of barium in a stomach with a normally functioning stoma.

Fig. 3. A. Film taken immediately after a barium meal and before administration of saline. The barium has already reached the cecum.
B. Film taken 5 minutes after administration of saline shows the meal well within the colon. On none of the other films is the jejunum visualized.

lous communication between the colon and the jejunum or stomach in gastrojejunocolic fistula (8).

The roentgen observations depend on the surgery performed. With gastric resection the findings will be those shown in the accompanying case report, which can be summarized briefly as follows: Barium passes rapidly into the ileal anastomosis from the resected portion of the stomach. Because the barium traverses only a few segments of ileum, it will quickly appear in the cecum, frequently during the fluoroscopic phase of the examination. Study of the roentgenograms will reveal barium in the gastric stump as well as in the cecum, and only a few loops of barium-filled small bowel. These, from their appearance and location, can usually be recognized as ileum, and on occasion the loop of ileum extending from stomach to cecum may be identified. The entire jejunum, being by-passed, will not be demonstrated.

Gastroileostomy without gastric resection and with a patent pylorus presents somewhat different roentgen features. The barium meal in such cases will leave the stomach both by the pylorus and the gastric stoma. The entire small bowel will be visualized as contrasted to the by-passed jejunum in gastroileostomy with gastric resection. The diagnostic feature, as Brown has shown, is the delayed film examination, showing refilling of the stomach four or five hours following the barium meal.

CASE REPORT

A 46-year-old white male taxi driver was admitted to the New York Hospital complaining of diarrhea for the past year. He gave a history of the onset of epigastric pain four years earlier, radiating on occasion to the back, with some associated nausea and episodes of vomiting. The pain at first responded to Amphojel therapy. The patient did not maintain any specific dietary regimen and was seen by various physicians and clinics without notable relief of symptoms. One year prior to admission he experienced a severe attack of epigastric pain following a tarry stool. He was admitted to another hospital, where an upper gastrointestinal series was said to show a perforated gastric ulcer. A subtotal gastrectomy and gastroenterostomy were said to have been performed. The patient did well until one week postoperatively, when he had a severe attack of nausea and vomited a pint of red blood. He was given two transfusions and bleeding ceased.

Fig. 4. Second small bowel study without saline but with films taken at five, fifteen, thirty, and sixty minutes revealed barium in the cecum and ascending colon on the sixty-minute film. Again, only a few segments of small bowel are demonstrated, which from their location and appearance seem to be distal ileum. The entire jejunum and proximal ileum appear to have been by-passed.

During the immediate postoperative convalescence diarrhea developed, continuing at constant intensity until admission to the New York Hospital, with eight to ten soft, loose, yellow to green bowel movements of large volume each day. Occasionally the stools contained undigested food. Nausea was sometimes experienced after meals. There was no further history of gastrointestinal bleeding, nor was there any pain or vomiting. The patient complained of being chronically tired since his operation and had lost 30 pounds over the last year, despite a good appetite.

Physical Examination: The patient was well developed but thin and malnourished. No significant abnormalities were found.

Laboratory Data: Urinalysis was normal. Red blood cells numbered 4,300,000; white cells 11,500, with a normal differential count; hemoglobin 12.0 gm. Serologic tests were negative. The blood chemistry was normal. The guaiac reaction of the stool was 1 and 2 plus. Cultures of the feces were negative, and no ova or para-

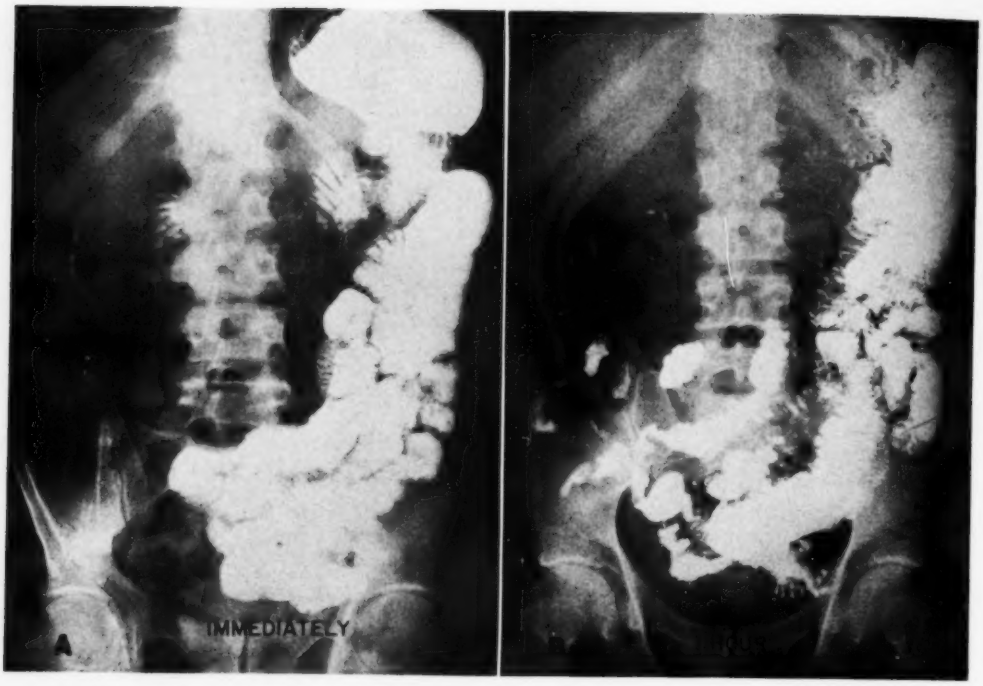


Fig. 5. Postoperative examination reveals a high resection of stomach with normal appearing stoma (A). The small bowel study by the conventional method of hourly film examinations at one to four hours now shows the entire small bowel. The meal has reached the cecum on the 4-hour film. Compare with appearance in Figs. 3 and 4.

sites were found. Gastric analysis showed a total acidity of 10 degrees at thirty minutes.

Roentgen Examination: Barium meal examination of the upper gastrointestinal tract demonstrated what appeared to be a subtotal gastric resection with a normally functioning stoma and no evidence of marginal ulceration. During the fluoroscopic phase of the examination, barium was seen to appear suddenly in the cecum. Spot films obtained at this time demonstrated portions of the barium meal in the stomach, in a few segments of the ileum, and in the cecum (Figs. 1 and 2). Subsequent fluoroscopic examination of the stomach and small bowel again showed almost simultaneous filling of the stomach and cecum. A small-bowel study by the rapid method of Weintraub (10) (Fig. 3) revealed the meal to be well within the proximal colon on the five-minute film, with further rapid progression at fifteen and thirty minutes. Moreover, only a few segments of small bowel were visualized, which from their appearance and location seemed to be ileum. The entire jejunum appeared to have been by-passed. A second small bowel examination, without the use of cold saline but with films taken at five, fifteen, thirty, and sixty minutes, demonstrated an abnormally rapid transit of the meal from stomach to cecum. The head of the

barium column was in the cecum on the sixty-minute film. Again the only part of the small bowel visualized was a few segments of distal ileum (Fig. 4).

These roentgenographic findings, correlated with the history of onset of diarrhea shortly following a gastroenterostomy, permitted a radiographic diagnosis of gastroileostomy.

Operative Findings: On the basis of the roentgen findings exploration was undertaken, revealing an indurated 2 cm. ulcer of the first portion of the duodenum. Just proximal to the ulcer was a marked stricture at the pyloric sphincter due to a non-absorbable ligature that had been placed around the duodenum at this point. There was no evidence that a gastrectomy had been performed. An antecolic anterior gastroenterostomy with a normally functioning stoma and without evidence of marginal ulcer was demonstrated. On tracing out the afferent and efferent loops of the gastroenterostomy, it was found that an antiperistaltic anastomosis had been done between the stomach and the ileum only three feet proximal to the ileocecal valve, so that the patient had been using only approximately three feet of small intestine for digestive and absorptive purposes. The gastroileostomy was dismantled and an end-to-end anastomosis of the ileum was performed. A gastric resection and gastrojejunostomy were then done.

The postoperative diagnosis was gastroterminal ileostomy.

Postoperative Roentgen Examination: Examination of the stomach and small bowel on the twenty-first postoperative day revealed a high subtotal gastric resection with normally functioning stoma. Hourly films for four hours demonstrated the entire small bowel. Transit time was normal, with the head of the meal in the right colon on the four-hour film. Compare the postoperative small bowel study (Fig. 5) with the preoperative examinations, in which none of the jejunum and only a few segments of distal ileum were demonstrated.

SUMMARY

Gastroileostomy is a comparatively rare surgical error. It is possible that it may occur more frequently as a result of the recent wave of enthusiasm for vagotomy and gastroenterostomy as a treatment for duodenal ulcer. The clinical and roentgen findings have been discussed and a case has been added to the literature.

525 East 68th Street,
New York, N. Y.

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SUMARIO

Gastroileostomía

La gastroileostomía constituye un error quirúrgico algo extraño, pero que, sin embargo, es de esperar aumente en frecuencia con el auge del entusiasmo en pro de la vagotomía y la gastroenterostomía como tratamiento para la úlcera duodenal.

Los síntomas sobresalientes son pérdida de peso, diarrea, dolor y vómitos. Los hallazgos roentgenológicos dependen de la clase de cirugía ejecutada. Con la resección gástrica, el bario pasa rápidamente a la anastomosis ileal y pronto aparece en el ciego, frecuentemente ya al hacer el estudio roentgenoscópico. Las radiografías revelan bario en el muñón gástrico y en el ciego, y algunas asas del intestino delgado llenas de dicha substancia. El yeyuno no se llena. En los casos sin gastrectomía, se visualizará todo el intestino delgado. La característica del diagnóstico en esos casos consiste en el rehenchimiento del estómago unas cuatro o cinco horas después de administrar la comida de bario. Preséntase un caso.

EDITORIAL

Clinical Observations and Research

The casual observer is prone to believe that clinical medicine has been so card-catalogued and well documented that few if any new disease processes remain to be studied and described. Countless pathologic conditions, however, are seen in everyday practice, of whose origin and significance we are not aware. An example of this is to be found in the story of a report of what appeared to be a relatively rare and unimportant bone lesion but later proved to be part of a clinical syndrome of interest.

In 1946 Fong reported a case of iliac horns (symmetrical bilateral central posterior iliac processes) in a patient with no unusual clinical features except for hypertension during pregnancy. No previous cases of this anomaly had been recorded in the literature.

In 1947 a series of four similar cases was presented by Thompson, Walker, and Weens, who showed that these abnormal iliac processes were not independent curiosities but were a part of a complex hereditary syndrome characterized by dystrophy of the fingernails and arthrodysplasia of certain joints, especially the patellae. The first two patients were a father and son, while the other two were unrelated. In their discussion of the subject, Thompson and his associates stated that the condition is not sex-linked and is transmitted as a dominant hereditary character. They refer to Chatelain as recognizing this as early as 1820, though not all of the features were linked until the present time. These writers also point out that iliac horns constitute only one anatomical anomaly associated with the syndrome and that these are not always present.

Hawkins and Smith in 1950 published the record of a family in which 36 members were traced or observed. In 21 of these patients developmental anomalies of some type were discovered. Four were found to be suffering from a renal lesion similar to chronic glomerulonephritis. Nine members of this family were found to have iliac horns in addition to many other abnormalities, such as changes in the fingernails, elbows, patellae, etc.

More recently Böck reported a case of iliac horns occurring in a patient of 19 who also had hypoplasia of the patella and faulty development of the fingernails. These anomalies were observed also in the patient's mother and two sisters.

This brief résumé of the piecing together of the associated parts of a single syndrome illustrates effectively the opportunities for clinical research which are still present in spite of the brilliant accomplishments of the past. There are many other examples of clinical discoveries in recent years which have been aided or initiated by radiologists. Clinical research has greater limitations from lack of interest and persistence than from lack of clinical material.

REFERENCES

Böck, K.: Pelvic Horns: A Congenital Hereditary Anomaly Within the Framework of a Malformation Syndrome. Fortschr. a. d. Geb. d. Röntgenstrahlen **74:** 543–549, May 1951. Abstracted in Radiology **58:** 616, April 1952.

Fong, E. E.: "Iliac Horns" (Symmetrical Bilateral Central Posterior Iliac Processes). A Case Report. Radiology **47:** 517–518, November 1946.

Thompson, E. A., Walker, E. T., and Weens, H. S.: Iliac Horns (An Osseous Manifestation of Hereditary Arthrodysplasia Associated with Dystrophy of the Fingernails). Radiology **53:** 88–92, July 1949.

Hawkins, C. F., and Smith, O. E.: Renal Dysplasia in a Family with Multiple Hereditary Abnormalities Including Iliac Horns. Lancet **1:** 803–808, April 29, 1950.

RADIOLOGICAL SOCIETY OF NORTH AMERICA

THIRTY-EIGHTH ANNUAL MEETING

Netherland-Plaza Hotel, Cincinnati, Ohio, December 7–12, 1952

PRELIMINARY PROGRAM

Monday, December 8

OPENING SESSION: 10:30 A.M.–12:30 P.M.

Call to Order. JOSEPH C. BELL, M.D., President

Welcoming Remarks. DANIEL E. EARLEY, M.D., President, Cincinnati Academy of Medicine

Presidential Address. Radiology a Medical Specialty. JOSEPH C. BELL, M.D.

The Indications and Value of Uterosalpingography. LAMAN A. GRAY, M.D.

Routine Clinical Experiences Using Urokon Sodium 70% in Intravenous Urography. CAREY N. BARRY, M.D., ROBERT ROYCE, M.D., D. K. ROSE, M.D., ARTHUR A. PORPORIS, M.D., OSCAR C. ZINK, M.D., and HUGH M. WILSON, M.D.

Medullary Fixation of the Femur. HUGH SMITH, M. D.

AFTERNOON SESSION: 2:00–4:30 P.M.

The Care of the Incurable Cancer Patient. BERNARD P. WIDMANN, M.D.

Differential Diagnosis of Chronic Perforating Carcinoma of the Colon. CLYDE A. STEVENSON, M.D., and ARNO W. SOMMER, M.D.

Double-Contrast Examinations in the Diagnosis of Some Lesions of the Large Bowel. JAMES B. DOUGLAS, M.D.

Dilute Contrast Media in the Diagnosis of Lesions of the Colon. R. M. POTTER, M.D.

The Detection of Colonic Polypi by High Voltage Radiography. CESARE GIANTURCO, M.D., and GEORGE A. MILLER, M.D.

EXECUTIVE SESSION: 4:30 P.M.

Tuesday, December 9

MORNING SESSION: 10:30 A.M.–12:30 P.M.

The Prepyloric Suspect Lesion. FAY K. ALEXANDER, M.D.

The Roentgen Visualization of the Mucosal Pattern of the Gastrointestinal Tract. EVERETT L. PIRKEY, M.D., PETER K. KNOEFEL, M.D., LAWRENCE A. DAVIS, M.D., and JANE TELFORD, M.D.

Developmental Abnormalities of the Duodenum Producing Obstruction. RICHARD F. MCCLURE, M.D., and ELMER F. WAHBY, M.D.

Short Esophagus with Marginal Ulceration. BERNARD S. WOLF, M.D., MAX L. SOM, M.D., and RICHARD H. MARSHAK M D.

AFTERNOON SESSION: 2:00–4:30 P.M.

Radiation Therapy of Malignant Lesions About the Eye. MILFORD D. SCHULZ, M.D., and CHARLES G. STETSON, M.D.

Calculations and Direct Measurements in Radium Therapy of Carcinoma of the Cervix. GILBERT H. FLETCHER, M.D., ROBERT J. SHALEK, M.A., JOHN A. WALL, M.D., and FERNANDO G. BLOEDORN, M.D.

The Irradiation Management of Primary Round-Cell Tumors of Bone. JOHN H. WALKER, M.D.

Radiation Necrosis of the Mandible. ORLISS WILDERMUTH, M.D., and SIMEON T. CANTRIL, M.D.

The Superior Vena Cava Compression Syndrome in Bronchogenic Carcinoma—Pathologic Physiology and Therapeutic Management. BERNARD ROSWIT, M.D., GUSTAVE KAPLAN, M.D., and HAROLD G. JACOBSON, M.D.

EXECUTIVE SESSION: 4:30 P.M.

THE CARMAN LECTURE 8:00 P.M.

The Place of Physics in Clinical Radiology
Richard H. Chamberlain, M.D.
Philadelphia, Penna.

Wednesday, December 10

MORNING SESSION: 10:30 A.M.–12:30 P.M.

The Relationship of the Female Urethra and Bladder in Urinary Stress Incontinence. C. PAUL HODGKINSON, M.D., and HOWARD P. DOUB, M.D.

Preliminary Observations Regarding the Value of a Fractional Focus Tube in Radiographic Diagnosis. ERNEST H. WOOD, M.D.

The Role of Roentgen Therapy in the Treatment of Rheumatoid Spondylitis (Marie-Strümpell's Arthritis). JEAN BOUCHARD, M.D.

The Value of Delayed Films in Bronchography. HERBERT L. ABRAMS, M.D., GERHARD R. HENCKY, M.D., and HENRY S. KAPLAN, M.D.

AFTERNOON SESSION: 2:00–4:30 P.M.

The Mode of Spread of Metastases by Way of the Vertebral Veins. OSCAR V. BATSON, M.D.

The Diagnosis and Treatment of the Post-Phlebitic Syndrome. DAVITT A. FELDER, M.D.

Protection to Radiologists in Fluoroscopy. SCOTT W. SMITH, Ph.D , and JOE R. BROOKS, Ph.D.

The Saskatchewan 1,000 Curie Cobalt^{60} Unit. T. A. WATSON, M.D., and H. E. JOHNS, Ph.D.

Roentgen Findings in Addison's Disease. J. LUTHER JARVIS, M.D., and DALTON JENKINS, M.D.

Thursday, December 11

MORNING SESSION: 10:30 A.M.–12:30 P.M.

Percutaneous Transhepatic Portal Venography. HOWARD L. STEINBACH, M.D., and EARL R. MILLER, M.D.

Historical Lecture—The Life of Walter Cannon. GEORGE W. HOLMES, M.D.

Diagnostic Radiology in War and Civil Defense. HAROLD I. AMORY, Colonel, M.C., U. S. A., and SCOTT W. SMITH, Ph.D.

Role of the Radiologist During Atomic Attack. JUSTIN STEIN, M.D., ALBERT W. BELLAMY, Ph.D., ANDREW H. DOWDY, M.D., and STAFFORD L. WARREN, M.D.

AFTERNOON SESSION: 2:00–4:00 P.M.

Borderlands Dim in Malignant Disease of the Blood-Forming Organs. R. PHILIP CUSTER, M.D.

Fungus Disease of Bone. ROBERT J. REEVES, M.D.

The Clinical Use and Results of the Localization of Brain Tumors with Radioactive Isotopes in 200 Patients. WM. B. SEAMAN, M.D., HENRY G. SCHWARTZ, M.D., MICHEL TER-POGOSSION, Ph.D.

Painful Lesions of the Shoulder Girdle. FRANK H. MAYFIELD, M.D.

EXECUTIVE BUSINESS SESSION: 4:00 P.M.

ANNUAL BANQUET 7:00 P.M.

Presentation of the Gold Medal of the Society

Music by Double Quartette from the Purdue Glee Club

Orchestra and Dancing, 10:00 P.M. until 1:00 A.M.

Friday, December 12

MORNING SESSION: 10:00 A.M.–1:00 P.M.

Side Effects of Angiocardiographic Injections. CHARLES T. DOTTER, M.D., MARTIN S. WETCHLER, M.D., and ISRAEL STEINBERG, M.D.

Roentgenological Differentiation of Pulmonary Tension Cysts in Infants and Children. J. A. CAMPBELL, M.D., and R. A. SILVER, M.D.

Coarctation of the Aorta. ROBERT D. SLOAN, M.D., and ROBERT N. COOLEY, M.D.

Primary Myocardial Disease of Infancy and Childhood. HAROLD D. ROSENBAUM, M.D., ALEXANDER S. NADAS, M.D., and EDWARD B. D. NEUHAUSER, M.D.

Unusual Bone Tumors in Infants and Children. JOHN F. HOLT, M.D.

Reduction of Intussusception by Barium Enema. BERTRAM R. GIRDANY, M.D., and GEORGE W. GRIER, M.D.

MEETING OF ALLIED SCIENTISTS

Sheraton-Gibson Hotel, Cincinnati, Ohio, Dec. 9–12, 1952

Tuesday, December 9

10:30 A.M.–1:00 P.M.

PHYSICAL AND CHEMICAL PROTECTION AGAINST RADIATION

Transport of Radium Sulfate from the Human Lung. L. D. MARINELLI and P. F. GUSTAFSON, Argonne National Laboratory.

Education and Training of Health Physicists. E. E. ANDERSON, Oak Ridge National Laboratory.

Attenuation of Obliquely Incident 0.66 and 1.25 Mev Radiations in Concrete and Steel. F. KIRN, R. KENNEDY, and H. O. WYCKOFF, National Bureau of Standards.

Effects of Acute Total-Body Irradiation on Salt and Water Metabolism and Their Clinical Significance. J. Z. BOWERS, V. DAVENPORT, N. CHRISTIANSEN, and J. GOODNER, University of Utah.

Personnel Protection for a Medical Betatron Installation. H. W. KOCH, National Bureau of Standards.

Wednesday, December 10

10:30 A.M.–1:00 P.M.

NEW TECHNICS IN THE USE OF HIGH-ENERGY RADIATIONS

Central Nervous System Changes Following Betatron Irradiation. A. ARNOLD, P. BAILEY, L. HAAS, and J. S. LAUGHLIN, University of Illinois.

Physical Aspects of Electron Beam Therapy. J. S. LAUGHLIN, J. OVADIA, J. W. BEATTIE, and W. J. HENDERSON, University of Illinois.

Convergent Beam Irradiator. C. B. BRAESTRUP, City of New York, Department of Hospitals, and D. T. GREEN and J. L. SNARR, Atomic Energy of Canada, Ltd.

Fifty Gram Radium Unit for Converging Beam Therapy. G. FAILLA, Columbia University.

Teletherapy Design Problems (Useful Sources). MARSHALL BRUCER, Oak Ridge Institute of Nuclear Studies.

Thursday, December 11

10:30 A.M.–1:00 P.M.

RADIATION MEASUREMENTS AND RELATED PROBLEMS

Failures, Flops, and False Localizations in Tracer Technic. K. E. CORRIGAN, Harper Hospital, Detroit, Michigan.

The Dosimetry of Beta Radiations. ROBERT LOEVINGER, Mt. Sinai Hospital, New York.

An Improved Clinical Dosemeter for the Measurement of Radiation. S. O. FEDORUK, H. E. JOHNS, E. R.

EPP, and T. A. WATSON, Saskatchewan Cancer Commission.

Comparison of Bactericidal Effects of Radiation from a Kilocurie Cobalt^{60} Source and of 3 Mev Cathode Rays and X-Rays Produced by a Van de Graaff Accelerator. S. A. GOLDBLITH, B. E. PROCTOR, and C. J. BATES, Massachusetts Institute of Technology.

Fast Neutron Dosimetry. G. S. HURST and R. H. RITCHIE, Oak Ridge National Laboratory.

Friday, December 12
10:30 A.M.–1:00 P.M.
RADIOBIOLOGY

Detection of Intraocular Tumors Using Radioactive Phosphorus. JACK S. KROHMER, CHARLES I. THOMAS, JOHN P. STORAASLI, and HYMER L. FRIEDELL, Western Reserve University.

Intracavitary Colloidal Gold. G. A. ANDREWS, SAM W. ROOT, RALPH M. KNISELEY, and HERBERT D. KERMAN, Oak Ridge Institute of Nuclear Studies.

A Sensitive Gamma Detecting Device (The Scintigraph) as a Clinical Tool in Diagnosis of Morphologic Abnormalities of the Human Thyroid Gland. F. K. BAUER, R. L. LIBBY, B. CASSEN, and W. GOODWIN, Radioisotope Unit, Veterans Administration, Los Angeles.

New Technic for the Diagnosis of Metastatic Carcinoma of the Liver Using Iodinated Human Serum Albumin. L. A. STIRRET, E. T. YUHL, and R. L. LIBBY, Radioisotope Unit, Veterans Administration, Los Angeles.

Diagnosis and Treatment of Hyperthyroidism by Radioiodine. E. R. MILLER, University of California.

Ladies' Program

Sunday, Dec. 7

1:00–4:00 P.M.: Registration (fourth floor foyer, Netherland-Plaza Hotel). Limited number of tickets available for telecast at WLW-T for Monday at 8:30 A.M. ("Morning Matinee").

Monday, Dec. 8

9:00 A.M.–5:00 P.M.: Registration
2:00 P.M.: Trip through WLW-T

Tuesday, Dec. 9

9:00 A.M.–5:00 P.M.: Registration
12:00 Noon: Luncheon at Vernon Manor Hotel, followed by visit to Eden Park Conservatory and (optional) Cincinnati Art Museum
8:00 P.M.: Carman Lecture

Wednesday, Dec. 10

9:00 A.M.–5:00 P.M.: Registration
9:15 A.M.: Telecast ("Breakfast Party," NBC) at WLW-T (limited number of tickets available at Ladies' Registration Desk)
2:45 P.M.: Tea at Town Club, Hotel Sinton. Mrs. Thomas Gardner will demonstrate "Styles in Christmas Packages."

Thursday, Dec. 11

9:00 A.M.–4:00 P.M.: Registration
9:15 A.M.: Telecast ("Breakfast Party," NBC) at WLW-T (limited number of tickets available at Ladies' Registration Desk)
10:00 A.M.: Trip to Taft Museum
7:00 P.M.: Banquet

Tickets for Luncheon and Tea may be obtained at Ladies' Registration Desk

ANNOUNCEMENTS AND BOOK REVIEWS

CHANGE IN BY-LAWS RADIOLOGICAL SOCIETY OF NORTH AMERICA, INC.

According to a directive from the Board of Directors at their meeting in Chicago last December, the By-Laws and Constitution Committee recommended a change in Article III, Section 8, of the By-Laws, removing the sentence relative to furnishing a certificate of Emeritus Membership. The sentence reads—"They shall receive a certificate of Emeritus Membership."

By removal of the above sentence, Article III, Section 8, will read.

"Section 8. Emeritus Membership. Emeritus members shall be those members of the Radiological Society of North America, Inc., whose long membership and service to radiology shall, in the judgment of the Board of Directors, entitle them to such membership. They shall be exempt from all dues and assessments and shall be ineligible to vote or hold office. They shall receive the journal of the Society and all other publications of the Society gratis."

As a point of explanation, this Committee has been informed by Doctor Donald S. Childs, Secretary-Treasurer of the Radiological Society of North America, Inc., that such certificates have never been issued.

The Committee on By-Laws and Constitution of the Radiological Society of North America, Inc., therefore recommends the above change in Article III, Section 8, of the By-Laws of the Society and is using this means of submitting such recommendation of change to the membership sixty days prior to the meeting as required by the Constitution of the above named society.

Respectfully submitted,

Harold E. Nichols, M.D.

John H. Gilmore, M.D.

Robert D. Moreton, M.D., *Chairman*

AMERICAN RADIUM SOCIETY

The following officers were elected at the last annual meeting of the American Radium Society in Chicago: President, Howard B. Hunt, M.D., Omaha, Neb.; President-Elect, Edith H. Quimby, Sc. D., New York, N. Y.; First Vice-President, Wendell G. Scott, M.D., St. Louis, Mo.; Second Vice-President, J. Ernest Breed, M.D., Chicago, Ill.; Secretary, John E. Wirth, M.D., 635 Herkimer St., Pasadena, Calif.; Treasurer, Grant H. Beckstrand, M.D., Long Beach, Calif. The next meeting of the society will be held at the Plaza Hotel, St. Louis, Mo., April 19–22, 1953.

RADIOLOGICAL SECTION BALTIMORE CITY MEDICAL SOCIETY

At a recent meeting of the Radiological Section of the Baltimore City Medical Society, the following officers were elected for the current year: Chairman, Dr. Richard B. Hanchett; Secretary-Treasurer, Dr. H. Leonard Warres, 2337 Eutaw Place, Baltimore 17.

SECTION ON RADIOLOGY CONNECTICUT STATE MEDICAL SOCIETY

The following officers were elected on April 30, 1952, by the Section on Radiology of the Connecticut State Medical Society: Dr. Arnold H. Janzen, New Haven, President; Dr. William A. Goodrich, 85 Jefferson St., Hartford 14, Secretary-Treasurer.

SOUTH CAROLINA RADIOLOGICAL SOCIETY

At a recent meeting of the South Carolina X-ray Society, in conjunction with the annual meeting of the South Carolina Medical Association, the name of the organization was changed to South Carolina Radiological Society. The newly elected officers are: Dr. Malcolm Mosteller, Columbia, President; Dr. G. Carroll Brown, Walterboro, Vice-President; Dr. Henry E. Plenge, Spartanburg General Hospital, Spartanburg, Secretary-Treasurer.

BRITISH INSTITUTE OF RADIOLOGY PRELIMINARY ANNOUNCEMENT

It has been decided to re-establish the Annual Meeting of the British Institute of Radiology along the lines of the pre-war Annual Meeting. The dates fixed for 1952 are Thursday, December 4, and Friday, December 5. The meeting will be held at Church House, Westminster. With the kind cooperation of the Faculty of Radiologists and the Royal Society of Medicine, the Annual Meeting of the Institute will take the place of all radiological meetings in December.

The program will include a diagnostic symposium on "The Radiology of the Arterial System," a therapy symposium on "Hypopharyngeal Cancer," a radiobiology symposium which will deal with certain aspects of whole-body irradiation, and a scientific exhibition.

It is also hoped to present a short symposium primarily of interest to engineers and industrial members. The Mackenzie Davidson Memorial Lecture, to be given by Professor S. Knutsson, has been planned for one evening, and a dinner will be held on the second evening.

The provisional program is as follows:

Thursday, December 4

10:30–12:30	Opening ceremony and film of radiological interest
2:15–4:30	Diagnostic Symposium Radiobiology Symposium
8:30	Mackenzie Davidson Memorial Lecture

Friday, December 5

10:30–12:30	Diagnostic papers Papers on radiotherapy and radiobiology
2:15–4:30	Radiotherapy Symposium Industrial and Engineering Symposium
Evening	Dinner

Announcements regarding registration and other details will be made in the near future.

POSTGRADUATE COURSE HOSPITAL FOR JOINT DISEASES

A postgraduate course in roentgenographic interpretation of the diseases of bones and joints will be given by Dr. Maurice M. Pomeranz, Director of Radiology at the Hospital for Joint Diseases, New York City, in affiliation with Columbia University, College of Physicians and Surgeons, Oct. 1–Dec. 17, 1952. This will comprise a series of lectures covering the radiographic analysis of acute and chronic diseases of bones and joints, including granulomata, neurotrophic lesions, neoplasms, and the manifestations of nutritional and metabolic bone changes in children and adults.

RADIOLOGICAL SAFETY COURSE

A two-week special course covering all aspects of radiological safety will be conducted by the Post-Graduate Medical School of the New York University-Bellevue Medical Center in co-operation with the United States Atomic Energy Commission, beginning October 20. This course is designed to acquaint industrial hygienists, insurance engineers, state, federal, county and city health officials, industrial and research institution safety engineers, industrial physicians, and present and potential users of radioisotopes and x-ray equipment with the fundamentals of radiation safety. It will be given at the Institute of Industrial Medicine of the Post-Graduate Medical School.

Details may be obtained from the Office of the Dean, New York University Post-Graduate Medical School, 477 First Ave., New York 16.

Books Received

Books received are acknowledged under this heading, and such notice may be regarded as recognition of the courtesy of the sender. Reviews will be published in the interest of our readers and as space permits.

DISEASES OF THE CHEST. By T. ROYLE DAWBER, A.B., M.D., F.A.C.P., Senior Surgeon, U.S.P.H.S., Chief of Heart Disease Epidemiology Study, National Heart Institute; Assistant in Medicine, Harvard Medical School, and LLOYD E. HAWES, A.B., M.D. D.A.B.R., Radiologist at Faulkner Hospital; Consultant at U.S.P.H.S. Hospital, Boston. A volume of 440 pages, with 216 roentgenograms. Published by the Williams & Wilkins Co., Baltimore 2, Md., 1952. Price $10.00.

A STUDENTS' RADIOLOGICAL MATHEMATICS. ELEMENTARY MATHEMATICS APPLIED to MEDICAL RADIOLOGY. By L. A. W. KEMP, B.Sc., F. Inst. P., Physicist to the London Hospital, formerly Lecturer in Physics at the Polytechnic, London. A volume of 316 pages, with 128 figures. Published by Blackwell Scientific Publications Ltd., Oxford, England, by Charles C Thomas, Springfield, Ill., and by the Ryerson Press, Toronto, Canada, 1952. Price $5.00.

RARE MANIFESTATIONS OF METABOLIC BONE DISEASE. THEIR PRACTICAL IMPORTANCE. By I. SNAPPER, M.D., Ph.D., Physician and Director of Medical Education, Mt. Sinai Hospital; Clinical Professor of Medicine, Columbia University, College of Physicians and Surgeons, New York City. Twenty-ninth Annual Beaumont Lecture, delivered before the Wayne County Medical Society, Feb. 6, 1950. A monograph of 98 pages, with 11 tables and 18 figures. Published by Charles C Thomas, Springfield, Ill., 1952. $3.00.

TWELFTH SEMIANNUAL REPORT OF THE ATOMIC ENERGY COMMISSION, July 1952. 126 pages. Published by the United States Government Printing Office, Washington, D. C.

Book Reviews

PROGRESS IN BIOPHYSICS AND BIOPHYSICAL CHEMISTRY. VOLUME 2. Edited by J. A. V. BUTLER, Chester Beatty Research Institute, Royal Cancer Hospital, London, and J. T. RANDALL, F. R. S., Wheatstone Professor of Physics in the University of London, at King's College. A volume of 324 pages, with 118 figures and 10 tables. Published in Great Britain by Pergamon Press, Ltd., in the United States by Academic Press, Inc., New York, N. Y., 1951. Price $8.00

This well written, well indexed volume is a compilation of reviews of recent progress, in eight important branches of biophysics.

The opening essay, by M. M. Swann and J. M.

Mitchison, of the University of Cambridge, concerns the birefringence of cytoplasm and cell membranes and is devoted primarily to cogent criticism of current (through 1950) work in that field.

R. D. Preston, of Leeds, then discusses the biophysical aspects of polysaccharide structure in plants. In a well illustrated article, he considers chemical, x-ray, electron micrographic, and polarizing evidence bearing on the microstructure of plant cells and cell walls.

D. O. Jordan, of Nottingham, takes up the physicochemical properties of the nucleic acids. He considers in turn their degradation products and the copolymers themselves, covering rather thoroughly recent biophysical studies of these compounds.

The fourth chapter, more practical in nature than the others, is by W. K. Sinclair and L. F. Lamerton, of the Royal Cancer Hospital, London. These authors furnish a short (27 pp.) *Vade Mecum* for the clinician interested in applying radioactive isotopes to clinical problems.

B. D. Wyke, of Leeds, provides the longest (76 pp.) and most thoroughly documented (503 references) chapter, an interesting discussion of the biophysical aspects of nervous function. Equivalent circuits and physical models of individual neurones and their aggregates are considered, but the author throws cold water on systems of thought drawing too close an analogy between "mechanical brains" and their vital counterparts.

M. H. Pirenne, of Aberdeen, contributes a theoretical discussion of the quantum physics of vision, which is devoted to consideration of the minimal of quanta of light which can be detected by the human eye.

The only contributor from outside Great Britain is R. W. G. Wyckoff, of the National Institutes of Health, at Bethesda, Md., who writes on electron microscopy of developing bacteriophage and other viruses. After a brief discussion of technic, he presents an account of the results in this field, illustrated with twenty well chosen electron micrographs.

The volume concludes with a chapter on biological actions of ionizing radiations by L. H. Gray, of London.

EINFUHRUNG IN DIE RÖNTGENOLOGIE. EIN LEHRBUCH FUR ÄRZTE UND STUDIERENDE. By G. F. HAENISCH, A. O. Prof. Dr. Med., Chefarzt I. R. am allgemeinen Krankenhaus, Barmbeck, Hamburg, and H. HOLTHUSEN, O. Ö. Prof. Dr. Med., Chefarzt am allgemeinen. Krankenhaus, St. Georg, Hamburg, mit einem physikalischen-technischen Beitrag von A. LIECHTI, bearbeitet und ergänzt von Dr. W. FEHR, Hamburg. Fifth Edition. A volume of 522 pages, with 371 illustrations. Published by Georg Thieme, Stuttgart, 1951. Distributors for U. S. A. and Canada, Grune & Stratton, Inc., New York, N. Y. Price, DM 60.00

This book should probably be called "Introduction to Radiology" not "Introduction to Roentgenology," since it includes the use of radium, radioactive isotopes, and ionizing rays other than roentgen rays.

A short but well selected chapter on radiophysics and technic written by Liechti and Fehr, comprising about 50 pages, is followed by the two main sections of the volume: Diagnostic Roentgenology, written by Haenisch, and Radiotherapy, by Holthusen.

The diagnostic section is easily readable and in about 230 pages contains a wealth of roentgenologic knowledge. Yet the author does not lose himself in details. The main roads of the roentgenological examinations are clearly described. The more complicated diagnostic procedures, including the most modern ones, are only mentioned, but in such an interesting manner as to inspire the reader to further thought and stimulate wider investigation. The author seems to make much more use of planigraphy and kymography than is customary in America.

The section on radiotherapy is divided into a general and a special part. The general part contains an excellent chapter on radiobiology, which should be of great interest to many American readers. The text is quite modern and includes the essential facts of the most recent investigations in the fields of radioactive isotopes, ultra-high-voltage x-rays, neutron rays, etc. In the special part, the selection of the treatment procedure in individual cases conforms closely to the prevalent ideas of radiotherapy in this country, though the field allotted to radiotherapy at the expense of surgery is relatively much larger in Germany than in America. This is undoubtedly due to the phenomenal development of surgery in America in the last decade.

The book is printed on good paper, and the illustrations are excellent. The roentgenograms show good detail, but are printed in the "positive" instead of the "negative" form more familiar in America.

To the student this book will bring an inexhaustible treasure of knowledge. The experienced radiologist will enjoy reading it and will find that it places the newly acquired facts relating to his specialty in an orderly system and integrates the modern ideas into the store of knowledge which he had acquired in his school days.

TRATTATO DI STRATIGRAFIA. By PROF. A. VALLEBONA, with the collaboration of PROF. P. AMISANO, PROF. G. BALESTRA, PROF. E. VITALE, DR. A. DE MAESTRI, DR. G. GARDELLA, DR. N. MACARINI, DR. L. OLIVA, DR. A. PASSERI, DR. F. PERASSI, DR. A. PIAZZA, DR. A. ROLLANDI, DR. G. SANQUIRICO, and DR. R. VIGNOLINI. A volume of 348 pages, with 290 figures. Casa Editrice Dottor Francesco Vallardi, Milan, 1952.

Professor Vallebona has been working in the field of laminagraphy for many years and he is responsible for many of its first clinical applications and for several of its technical developments. In the past two years he has been in charge of a course of in-

struction in this field which has attracted to the University of Genoa many European radiologists. For this reason, his book is particularly welcome, as it summarizes his own experience and that of his thirteen collaborators.

The first chapter deals with the history and development of longitudinal and axial laminagraphy. The second and third chapters present the theoretical and geometrical basis of this technic. The fourth chapter describes in detail the apparatus available today. Chapters V to XV are devoted to detailed discussions of the laminagraphic findings in diseases of the lung, pleura, and mediastinum. Chapter XVI deals with diseases of the heart and large vessels, and Chapter XVII with the larynx and pharynx.

One of the most interesting chapters is the eighteenth, in which Dr. Macarini describes the technic of visualization of the pancreas by means of insufflation of the stomach, retroperitoneum, and axial laminagraphy. Chapter XIX concerns the applications of laminagraphy to the skull and ventricular system. The final chapter presents the results obtained in laminagraphy of the skeleton.

The book has excellent illustrations, showing faultless radiographic and laminagraphic technic. Professor Vallebona and his co-workers have made a real contribution by publishing their results.

RADIOLOGICAL SOCIETIES: SECRETARIES AND MEETING DATES

Editor's Note: Secretaries of state and local radiological societies are requested to co-operate in keeping this section up-to-date by notifying the editor promptly of changes in officers and meeting dates.

RADIOLOGICAL SOCIETY OF NORTH AMERICA. *Secretary-Treasurer*, Donald S. Childs, M.D., 713 E. Genesee St., Syracuse 2, N. Y.

AMERICAN RADIUM SOCIETY. *Secretary*, John E. Wirth, M.D., 635 Herkimer St., Pasadena 1, Calif.

AMERICAN ROENTGEN RAY SOCIETY. *Secretary*, Barton R. Young, M.D., Germantown Hospital, Philadelphia 44, Penna.

AMERICAN COLLEGE OF RADIOLOGY. *Exec. Secretary*, William C. Stronach, 20 N. Wacker Dr., Chicago 6.

SECTION ON RADIOLOGY, A. M. A. *Secretary*, Paul C. Hodges, M.D., 950 East 59th St., Chicago.

Alabama

ALABAMA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, J. A. Meadows, Jr., M.D., Medical Arts Bldg., Birmingham 5.

Arizona

ARIZONA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, R. Lee Foster, M.D., 15 East Monroe, Phoenix. Annual meeting with State Medical Association; interim meeting in December.

Arkansas

ARKANSAS RADIOLOGICAL SOCIETY. *Secretary*, Fred Hames, M.D., Pine Bluff. Meets every three months and at meeting of State Medical Society.

California

CALIFORNIA MEDICAL ASSOCIATION, SECTION ON RADIOLOGY. *Secretary*, Calvin L. Stewart, M.D., 2330 First Ave., San Diego.

EAST BAY ROENTGEN SOCIETY. *Secretary*, Dan Tucker, M.D., 434 30th St., Oakland 9. Meets monthly, first Thursday, at Peralta Hospital.

LOS ANGELES RADIOLOGICAL SOCIETY. *Secretary*, John B. Hamilton, M.D., 210 N. Central Ave., Glendale 3. Meets monthly, second Wednesday, Los Angeles County Medical Association Bldg.

NORTHERN CALIFORNIA RADIOLOGICAL CLUB. *Secretary*, G. A. Fricker, Sacramento Co. Hospital, Sacramento 17. Meets at dinner last Monday of September, November, January, March, and May.

PACIFIC ROENTGEN SOCIETY. *Secretary*, L. Henry Garland, M.D., 450 Sutter St., San Francisco 8. Meets annually at time of California State Medical Association convention.

SAN DIEGO RADIOLOGICAL SOCIETY. *Secretary*, Rex Uncapher, M.D., 7720 Girard Ave., La Jolla. Meets first Wednesday of each month.

SAN FRANCISCO RADIOLOGICAL SOCIETY. *Secretary*, I. J. Miller, M.D., 2680 Ocean Ave., San Francisco 27. Meets quarterly, at the University Club.

SOUTH BAY RADIOLOGICAL SOCIETY. *Secretary*, Ford Shepherd, M.D., 526 Soquel Ave., Santa Cruz. Meets monthly, second Wednesday.

X-RAY STUDY CLUB OF SAN FRANCISCO. *Secretary*, Charles E. Duisenberg, M.D., Palo Alto Clinic, 300 Homer Ave., Palo Alto. Meets third Thursday at 7:45, January to June at Stanford University Hospital, July to December at San Francisco Hospital.

Colorado

COLORADO RADIOLOGICAL SOCIETY. *Secretary*, Wendell P. Stampfli, M.D., 1933 Pearl St., Denver. Meets monthly, third Friday, at University of Colorado Medical Center or Denver Athletic Club.

Connecticut

CONNECTICUT STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary-Treasurer*, William A. Goodrich, M.D., 85 Jefferson St., Hartford 14. Meets bimonthly, second Wednesday.

CONNECTICUT VALLEY RADIOLOGICAL SOCIETY. *Secretary*, B. Bruce Alicandri, M.D., 20 Maple St., Springfield, Mass. Meets second Friday of October and April.

District of Columbia

RADIOLOGICAL SECTION, DISTRICT OF COLUMBIA MEDICAL SOCIETY. *Secretary*, U. V. Wilcox, M.D., 915 19th St., N.W., Washington 6. Meets third Thursday, January, March, May, and October, at 8:00 P.M., in Medical Society Library.

Florida

FLORIDA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, A. Judson Graves, M.D., 2002 Park St., Jacksonville. Meets in April and in November.

GREATER MIAMI RADIOLOGICAL SOCIETY. *Secretary*, Maurice Greenfield, M.D., Ingraham Bldg., Miami. Meets monthly, third Wednesday, 8:00 P.M., Veterans Administration Bldg., Miami.

Georgia

ATLANTA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Albert A. Rayle, Jr., M.D., 478 Peachtree St. Meets second Friday, September to May.

GEORGIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Robert M. Tankesley, M.D., 218 Doctors Bldg., Atlanta. Meets in November and at the annual meeting of the State Medical Association.

RICHMOND COUNTY RADIOLOGICAL SOCIETY. *Secretary*, Wm. F. Hamilton, Jr., M.D., University Hospital, Augusta.

Hawaii

RADIOLOGICAL SOCIETY OF HAWAII. *Secretary*, Col. Alexander O. Haff, Tripler Army Hospital, Honolulu. Meets monthly on the third Friday, at Tripler Army Hospital.

Illinois

CHICAGO ROENTGEN SOCIETY. *Secretary*, Elbert K. Lewis, M.D., 6337 S. Harvard Ave., Chicago 21. Meets at the University Club, second Thursday of October, November, January, February, March, and April at 8:00 P.M.

ILLINOIS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Stephen L. Casper, M.D., Physicians and Surgeons Clinic, Quincy.

ILLINOIS STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary*, George E. Irwin, Jr., M.D., 427 N. Main St., Bloomington.

Indiana

INDIANA ROENTGEN SOCIETY. *Secretary-Treasurer*, John A. Robb, M.D., 23 East Ohio St., Indianapolis. Annual meeting in May.

Iowa

IOWA X-RAY CLUB. *Secretary*, James McMillen, M.D., 1104 Bankers Trust Bldg., Des Moines. Meets during annual session of State Medical Society, and holds a scientific session in the Fall.

Kansas

KANSAS RADIOLOGICAL SOCIETY. *Secretary*, Willis L. Beller, M.D., 700 Kansas Ave., Topeka. Meets in the Spring with the State Medical Society and in the Winter on call.

Kentucky

KENTUCKY RADIOLOGICAL SOCIETY. *Secretary*, Everett L. Pirkey, M.D., Louisville General Hospital. Meets monthly, second Friday, at Seelbach Hotel, Louisville.

Louisiana

ORLEANS PARISH RADIOLOGICAL SOCIETY. *Secretary*, Joseph V. Schlosser, M.D., Charity Hospital of Louisiana, New Orleans 13. Meets first Tuesday of each month.

SHREVEPORT RADIOLOGICAL CLUB. *Secretary*, W. R. Harwell, M.D., 608 Travis St. Meets monthly September to May, third Wednesday.

Maine

MAINE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Clark F. Miller, M.D., Central Maine General Hospital, Lewiston. Meets three times a year—Spring, Summer, and Fall.

Maryland

BALTIMORE CITY MEDICAL SOCIETY, RADIOLOGICAL SECTION. *Secretary-Treasurer*, H. Leonard Warres, 2337 Eutaw Place, Baltimore 17. Meets third Tuesday, September to May.

Michigan

DETROIT X-RAY AND RADIUM SOCIETY. *Secretary*, James C. Cook, M.D., Harper Hospital, Detroit 1. Meets first Thursday, October to May, at Wayne County Medical Society club rooms.

Minnesota

MINNESOTA RADIOLOGICAL SOCIETY. *Secretary*, Leo A. Nash, M.D., 572 Lowry Medical Arts Bldg., St. Paul 2. Meets in Spring and Fall.

Mississippi

MISSISSIPPI RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John W. Evans, M.D., 621 High St., Jackson 2, Miss. Meets monthly, third Tuesday, at 6:30 P.M., at the Rotisserie Restaurant, Jackson.

Missouri

RADIOLOGICAL SOCIETY OF GREATER KANSAS CITY. *Secretary*, Sidney Rubin, M.D., 410 Professional Bldg., Kansas City, Mo. Meets last Friday of each month.

ST. LOUIS SOCIETY OF RADIOLOGISTS. *Secretary*, Francis O. Trotter, Jr., M.D., 634 North Grand Blvd., St. Louis 3. Meets on fourth Wednesday, October to May.

Nebraska

NEBRASKA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Russell W. Blanchard, M.D., 1216 Medical Arts Bldg., Omaha. Meets fourth Thursday of each month at 6 P.M. in Omaha or Lincoln.

New England

NEW ENGLAND ROENTGEN RAY SOCIETY. *Secretary*, Stanley M. Wyman, M.D., Massachusetts General Hospital, Boston 14. Meets monthly on third Friday, at the Harvard Club, Boston.

New Hampshire

NEW HAMPSHIRE ROENTGEN SOCIETY. *Secretary*, Albert C. Johnston, M.D., 127 Washington St., Keene.

New Jersey

RADIOLOGICAL SOCIETY OF NEW JERSEY. *Secretary*, Nicholas G. Demy, M.D., 912 Prospect Ave., Plainfield. Meets at Atlantic City at time of State Medical Society and midwinter in Elizabeth.

New York

BUFFALO RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Mario C. Gian, M.D., 610 Niagara St., Buffalo 1. Meets second Monday, October to May.

CENTRAL NEW YORK ROENTGEN SOCIETY. *Secretary*, Dwight V. Needham, M.D., 608 E. Genesee St., Syracuse 2. Meets in January, May, October.

KINGS COUNTY RADIOLOGICAL SOCIETY. *Secretary*, Marcus Wiener, M.D., 1430 48th St., Brooklyn 19. Meets fourth Thursday, October to April (except December), at 8:45 P.M., Kings County Medical Bldg.

NASSAU RADIOLOGICAL SOCIETY. *Secretary*, Joseph J. La Vine, M.D., 259 North Grand Avenue, Baldwin, N.Y. Meets second Tuesday, February, April, June, October, and December.

NEW YORK ROENTGEN SOCIETY. *Secretary*, Harold W. Jacox, 622 W. 168th St., New York 32.

NORTHEASTERN NEW YORK RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John F. Roach, M.D., Albany Hospital, Albany. Meets at University Club, Albany, second Wednesday, October, November, and March. Annual meeting in June.

ROCHESTER ROENTGEN-RAY SOCIETY. *Secretary-Treasurer*, Robert J. Bloor, 260 Crittenden Blvd. Meets at Strong Memorial Hospital, last Monday of each month, September through May.

WESTCHESTER RADIOLOGICAL SOCIETY. *Secretary*, Walter J. Brown, M.D., Northern Westchester Hospital, Mount Kisco, N. Y. Meets third Tuesday of January and October and at other times as announced.

North Carolina

RADIOLOGICAL SOCIETY OF NORTH CAROLINA. *Secretary*, Waldemar C. A. Sternbergh, 1400 Scott Ave., Charlotte 2. Meets in April and October.

North Dakota

NORTH DAKOTA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, H. Milton Berg, M.D., Quain & Ramstad Clinic, Bismarck. Meets in the Spring with State Medical Association and in the Fall or Winter on call.

Ohio

OHIO STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Willis S. Peck, M.D., 1838 Parkwood Ave., Toledo 2. Meets with State Medical Association.

CENTRAL OHIO RADIOLOGICAL SOCIETY. *Secretary*, Frank A. Riebel, M.D., 15 W. Goodale St., Columbus. Meets second Thursday, October, December, February, April, and June, 6:30 P.M., Columbus Athletic Club, Columbus.

CLEVELAND RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Mortimer Lubert, M.D., Heights Medical Center Bldg., Cleveland Heights 6. Meets at 6:45 P.M. on fourth Monday, October to April, inclusive.

GREATER CINCINNATI RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Harry K. Hines, M.D., 2508 Auburn Ave., Cincinnati 19. Meets first Monday of each month, September to June, at Cincinnati General Hospital.

MIAMI VALLEY RADIOLOGICAL SOCIETY. *Secretary*, Geo. A. Nicoll, M.D., Miami Valley Hospital, Dayton. Meets monthly, second Friday.

Oklahoma

OKLAHOMA STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John R. Danstrom, M.D., Medical Arts Bldg., Oklahoma City.

Oregon

OREGON RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, J. Richard Raines, M.D., Medical-Dental Bldg., Portland 5. Meets monthly, second Wednesday, October to June, at 8:00 P.M., University Club.

Pacific Northwest

PACIFIC NORTHWEST RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Sydney J. Hawley, M.D., 1320 Madison St., Seattle 4. Meets annually in May.

Pennsylvania

PENNSYLVANIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, James M. Converse, M.D., 416 Pine St., Williamsport 8. Meets annually.

PHILADELPHIA ROENTGEN RAY SOCIETY. *Secretary*, George P. Keefer, M.D., American Oncologic Hospital, Philadelphia 4. Meets first Thursday of each month at 5:00 P.M., from October to May, in Thompson Hall, College of Physicians.

PITTSBURGH ROENTGEN SOCIETY. *Secretary-Treasurer*, Donald H. Rice, M.D., West Penn Hospital, Pittsburgh 24. Meets monthly, second Wednesday, at 6:30 P.M., October to May, at Webster Hall.

Rocky Mountain States

ROCKY MOUNTAIN RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Maurice D. Frazer, M.D., 1037 Stuart Bldg., Lincoln, Nebr.

South Carolina

SOUTH CAROLINA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*. Henry E. Plenge, M.D., Spartanburg General Hospital, Spartanburg. Meets with State Medical Association in May.

South Dakota

RADIOLOGICAL SOCIETY OF SOUTH DAKOTA. *Secretary-Treasurer*, Marianne Wallis, M.D., 1200 E. Fifth Ave., Mitchell. Meets during annual meeting of State Medical Society.

Tennessee

MEMPHIS ROENTGEN CLUB. *Secretary*, John E. Whiteleather, M.D., 899 Madison Ave. Meets first Monday of each month at John Gaston Hospital.

TENNESSEE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, J. Marsh Frère, M.D., Newell Hospital, Chattanooga 2. Meets annually with State Medical Society in April.

Texas

DALLAS-FORT WORTH ROENTGEN STUDY CLUB. *Secretary*, Claude Williams, M.D., Fort Worth. Meets monthly, third Monday, in Dallas odd months, Fort Worth even months.

HOUSTON RADIOLOGICAL SOCIETY. *Secretary*, Frank M. Windrow, M.D., 1205 Hermann Professional Bldg.

SAN ANTONIO-MILITARY RADIOLOGICAL SOCIETY. *Secretary*, Hugo F. Elmendorf, Jr., M.D., 730 Medical Arts Building, San Antonio 5, Texas. Meets at Brook Army Medical Center, the first Monday of each month.

TEXAS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, R. P. O'Bannon, M.D., 650 Fifth Ave., Fort Worth. Next meeting Jan. 23–24, 1953, San Antonio.

Utah

UTAH STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Angus K. Wilson, M.D., 343 S. Main St., Salt Lake City 1. Meets third Wednesday, January, March, May, September, November.

Virginia

VIRGINIA RADIOLOGICAL SOCIETY. *Secretary*, P. B. Parsons, M.D., Norfolk General Hospital, Norfolk.

Washington

WASHINGTON STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John N. Burkey, M.D., 555 Medical-Dental Bldg., Seattle. Meets fourth Monday, September through May, at College Club, Seattle.

Wisconsin

MILWAUKEE ROENTGEN RAY SOCIETY. *Secretary-Treasurer*, Jerome L. Marks, M.D., 161 W. Wisconsin Ave., Milwaukee 1. Meets monthly on fourth Monday at the University Club.

SECTION ON RADIOLOGY, STATE MEDICAL SOCIETY OF WISCONSIN. *Secretary*, Abraham Melamed, M.D., 425 E. Wisconsin Ave., Milwaukee 2. Meets in October with State Medical Society.

UNIVERSITY OF WISCONSIN RADIOLOGICAL CONFERENCE. Meets first and third Thursday at 4 P.M., September to May, Service Memorial Institute.

WISCONSIN RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, W. W. Moir, M.D., Sheboygan Memorial Hospital, Sheboygan.

CANADA

CANADIAN ASSOCIATION OF RADIOLOGISTS. *Honorary Secretary-Treasurer*, Jean Bouchard, M.D. Assoc. Hon. Secretary-Treasurer, D. L. McRae, M.D. *Central Office*, 1555 Summerhill Ave., Montreal 26, Quebec. Meets in January and June.

LA SOCIÉTÉ CANADIENNE-FRANÇAISE D'ELECTROLOGIE ET DE RADIOLOGIE MÉDICALES. *General Secretary*, Origène Dufresne, M.D., Institut du Radium, Montreal. Meets third Saturday each month.

CUBA

SOCIEDAD DE RADIOLOGÍA Y FISIOTERAPÍA DE CUBA. Offices in Hospital Mercedes, Havana. Meets monthly.

MEXICO

SOCIEDAD MEXICANA DE RADIOLOGÍA Y FISIOTERAPÍA. *General Secretary*, Dr. Dionisio Pérez Cosio, Marsella 11. Mexico, D.F. Meets first Monday of each month.

PANAMA

SOCIEDAD RADIOLÓGICA PANAMEÑA. *Secretary-Editor*, Luis Arrieta Sánchez, M.D., Apartado No 86, Panama. R. de P.

PUERTO RICO

ASOCIACIÓN PUERTORRIQUEÑA DE RADIOLOGÍA. *Secretary*, Jesús Rivera Otero, M.D., Box 3542 Santurce, Puerto Rico.

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ROENTGEN DIAGNOSIS

THE HEAD AND NECK

Hereditary Factors in the Sutural Pattern of the Skull. Johan Torgersen. Acta radiol. **36:** 374–382, November 1951.

The author has previously dealt with the radiology of the metopic (or persistent mediofrontal) suture (Acta radiol. **33:** 1, 1950. Abst. in Radiology **55:** 907, 1950) and has studied its occurrence in a large series of families, including numerous sets of twins (Am. J. Phys. Anthropol. **9:** 193, 1951). He now reports a study of interparietal bones in the same material.

The metopic suture, which has been shown to be inherited as a dominant trait, and interparietal bones partly behave as manifestations of the same genes. Interparietal bones may occur as the only manifestation of these genes.

The author believes that there are probably two groups of genes influencing the sutural pattern of the skull, one determining the position of ossification centers and the other determining the rate of obliteration. Both the metopic suture and interparietal bones may be due to genes which delay closure. The effect of these genes may be influenced by the vascular supply. Considering the peculiar relationship between the pineal gland and the cranial sutures in some reptiles and amphibians, and the close topographical relationship of this structure to branches of the choroideal arteries, the straight sinus, and the vein of Galen, it seems probable that the pineal gland may be essential to the vascular mechanism, and by this means the genes affecting suture closure and the skull-brain correlation unfold their effect. The author suggests that study of the connection between calcification of the pineal gland and suture closure may throw some light on the obscure function of the former.

Fifteen roentgenograms; 1 drawing.

RODERICK L. TONDREAU, M.D.
University of Pennsylvania

Secondary Alterations of the Frontal Sinus in Cancer of the Paranasal Sinuses. Lewis L. Haas. Am. J. Roentgenol. **66:** 797–802, November 1951.

Secondary changes in the frontal sinus margins have been frequently observed by the author in roentgenograms of patients treated for cancer of the paranasal sinuses. These secondary alterations are grouped in three categories. The present discussion deals with that type in which the osseous change is restricted to the margins of the sinus and to its immediate bony surroundings. Among 65 cases of paranasal cancer receiving roentgen therapy, this observation was made in 23, or 35 per cent.

The earliest change demonstrable roentgenologically is a partial demineralization or disappearance of the white line representing the normal compact layer of the wall of the frontal sinus. Later smaller or larger sections of the contour, or sometimes the entire margin, present a blurred appearance. Occasionally the white line remains intact, though it will be obscured by condensation of the surrounding bone structures. In advanced stages, blurring of the outline is more marked. Frequently various grades of demineralization and condensation can be found simultaneously in different sections of the sinus wall.

Roentgenologically this alteration resembles low-grade secondary osteitis, which can be found occasionally in cases of long-standing infectious sinusitis. The most conspicuous difference between sinusitis and cancer cases is the moderateness and uniformity of the changes in sinusitis and the even distribution of the changes in the white line over the entire course. The irregular extensive blurring and condensation seen simultaneously in the tumor cases were observed only twice in an extensive series of chronic sinusitis films and in each instance there was a complicating osteomyelitis. Osteomyelitic destruction can produce similar blurring, but the margins are more irregularly ragged and the condensation is usually missing.

In spite of these differences, roentgenologically the alteration conforms in general to a benign secondary osteitis of the sinus wall, due to occlusion by the tumor. For a definite exclusion of the possibility of a secondary neoplastic invasion of the sinus wall, special postmortem examination of similar sinuses would be necessary. If it should be established, as it is assumed, that this alteration of the frontal sinus in cancer cases is always caused by benign secondary osteitis, the difference in frequency and in roentgenological appearance could be explained by the difference in consistency, course, duration, and degree of obstruction of the nasal passages between cancer cases and chronic inflammatory cases, respectively. When this alteration is encountered, clinical and roentgenologic examinations are recommended for diagnosis or exclusion of paranasal cancer. Roentgenographic observation of the frontal sinus is advocated in all cases of paranasal carcinoma and in doubtful cases.

Sixteen roentgenograms.

A. WILSON BROWN, M.D.
Shreveport (La.) Charity Hospital

The Mechanism of Injury to the Spinal Cord in the Neck Without Damage to the Vertebral Column. A. R. Taylor. J. Bone & Joint Surg. **33-B:** 543–547, November 1951.

This article presents a single case together with experimental observations and postmortem findings to support the author's belief that spinal cord injury without damage to the vertebral column in the cervical area is due to inward bulging of the ligamentum flavum during hyperextension of the neck. It was also noted that disk degeneration and adjacent osteophyte formation act as counter points to the pressure of the anterior bulging ligamenta flava. This probably accounts for the high incidence of cord injuries unassociated with damage to the spine in the elderly.

Eight roentgenograms; 1 photomicrograph.

H. GRIFFITH, M.D.
Indiana University

THE CHEST

Pulmonary Findings After Bronchography with Contrast Media Containing Carboxymethylcellulose. A. Werthemann and W. Vischer. Schweiz. med. Wchnschr. **81:** 1077–1080, Nov. 3, 1951. (In German)

Water-soluble iodized oils have been used for bronchography in the last few years in Switzerland. It was found that the addition of carboxymethylcellulose

(CMC), 2.5 per cent by volume, would sufficiently raise the viscosity of the contrast medium "Joduron" to warrant its use for bronchography. Following administration with added CMC it was found that the Joduron would be resorbed in a few hours. Experimental and clinical studies were undertaken to determine the manner and the rate of resorption of CMC.

Bronchography was performed in rats with the special contrast medium and microscopic sections of lung were prepared after ten, twelve, and eighteen months. In all of these sections CMC could be identified in the centers of small foci of granulation tissue in the lung.

The authors cite the clinical use of Joduron-CMC medium in 6 previously reported cases (Schweiz. med. Wchnschr. **81**: 54, 1951. Abst. in Radiology **57**: 900, 1951). Injury of a bronchus occurred in one bronchographic study and the contrast medium passed into the pleural space. Forty-two days later the affected lung had to be removed. Examination of the specimen showed small spotty thickenings of various size within the pleura. Microscopically, these thickenings were composed of nodules of granulation tissue within whose central portions were drop-like masses which, when stained by special means, were identified as CMC. Surrounding the drop-like masses were foreign-body giant cells.

It is concluded that CMC may be found in rat lungs as long as eighteen months following its use in bronchography, and that an inflammatory reaction may follow its use in man.

Two photomicrographs. ILONA D. SCOTT, M.D.
VA Hospital, Chamblee, Ga.

Bronchography under Intubation Anesthesia. W. Frommhold. Fortschr. a. d. Geb. d. Röntgenstrahlen **75**: 419–430, October 1951. (In German)

Intubation anesthesia with nitrous oxide and curare (or the less harmful synthetic preparation, Syncurine) offers the advantage of complete immobilization of the thorax during radiographic exposures. It can be performed without danger to the circulation and eliminates the discomfort incident to local anesthesia. The disadvantages of larger technical expenditures are outweighed by these advantages and are justified in many cases. The author especially recommends the procedure as the method of choice in sensitive patients and those with a "labile vegetative system."

Bronchography is indicated only when other examinations have failed to furnish the desired information. It should be done solely with water-soluble opaque media; according to the author, bronchography by means of iodized oil must now be considered malpractice.

Twenty-seven roentgenograms; 1 photograph.
ERNST A. SCHMIDT, M.D.
Denver, Colo.

Temporary Unilateral Occlusion of the Pulmonary Artery. A New Method of Determining Separate Lung Function and of Radiologic Examinations. Eric Carlens, Hans Erik Hanson, and Björn Nordenström. J. Thoracic Surg. **22**: 527–536, November 1951.

It is desirable to simulate preoperatively the functional conditions which will obtain after pneumonectomy, so as to determine whether or not a diseased lung can be safely removed. Attempts have been made to accomplish this by occluding the main bronchus to the diseased lung in the course of a bronchospirometric study. In some cases, however, it seems likely that the patient will do well after extirpation of the diseased lung even though he cannot tolerate the effect when its oxygen supply is discontinued preoperatively. This behavior is due to the presence of a venous shunt in the latter case. Thus, theoretically, a stoppage of the function of the diseased lung by occlusion of its branch of the pulmonary artery would seem to be less trying to the patient and more in line with postoperative conditions when all the venous blood flows to the remaining, respiring lung.

The authors report an experimental study in dogs and in 3 human beings, in which the pulmonary artery was occluded on one side by means of a cardiac catheter provided with an inflatable cuff of latex rubber. By this means the circulation in the pulmonary artery on one side and the oxygen uptake in the ipsilateral lung could be stopped. Thereby conditions were created which closely resembled the status following pneumonectomy, so that circulatory and respiratory changes resulting from extirpation of one lung could be foretold. No complications were observed.

The radiological applications of this procedure are apparent, when the method is understood. Following introduction of the catheter and inflation of the cuff, contrast material injected into the main pulmonary artery through a second catheter fills vessels of the unaffected lung only—thus indicating effective occlusion on the affected side. This method could therefore be safely and effectively employed when it is desirable to obtain a good lateral view of the circulation of one lung without interference from the opposite side.

Leisurely study of details of the vascular bed of the lung may be possible by injection of contrast material distal to an occluding cuff.

Five roentgenograms; 1 photograph; 1 bronchospirometric tracing. DONALD DEF. BAUER, M.D.
St. Paul, Minn.

Atelectases of the Lung: The Various Forms, Their Origin and Significance. Hanns Alexander. Monographien zur Monatsschrift "Der Tuberkulosearzt." Stuttgart, Georg Thieme, 1951, pp. 1–58. (In German)

The smooth musculature of the lungs extends in flat spirals from the bronchi to the bronchioli and then continuously down to the ducts of the smallest alveoli and up to the very rim of the alveolus. Of the total retractive power of the lungs, one-third is produced by the smooth muscles and by the elastic fibers of the lungs, and two-thirds by the surface tension of the small blister that forms the border between the cells of the alveolus and the air. The smaller the radius of the alveolus, the greater the surface tension. The optimum is reached if the radius of the alveolus equals the radius of the alveolar duct. In other words, if the blister forms half of a sphere around the end of the duct.

Inasmuch as the smooth musculature controls the width of the alveolar duct and therefore the size of the alveolar blister, the retractive power of the lungs is largely controlled by the smooth musculature or by the nerves that control the latter, chiefly the vagus and the sympathicus. Substances that stimulate the vagus will produce a narrowing of the bronchial lumina and substances that inhibit the vagus will produce a widening. The sympathicus works in the opposite direction. Regulation of the blood vessels goes hand in hand with these changes. Changes in the equilibrium between

the vagus and the sympathicus may be produced by local irritation (for instance inflammation) in the area involved, but the threshold of the equilibrium is subject to great individual variations and hypersensitivity is very common, particularly in nervous individuals.

A pure contraction atelectasis solely on a neurovegetative basis ("lung spasm" according to Sturm) is probably quite rare, but some local increase in the lung tonus and therefore some contraction is probably common in most mechanical atelectases. This can be proved by serial bronchography, whereby it can be shown that, due to the irritative effect of the oil, there are changes in the caliber of the bronchi which can be explained only by variation in tonus. A contraction atelectasis is dependent chiefly on individual hyperirritability and, in addition, a sufficiently large surface extension of an irritating agent and perhaps, also, an unusually strongly developed bronchial musculature. An active retraction of the lung can be proved in many cases of acute mechanical bronchial obstruction with the development of apneumatosis almost instantaneously or at least too rapidly to justify the assumption of spontaneous absorption. Neurovegetative irritation producing an active retraction of the lung structure may be produced by changes in the bronchi, pleuritic irritation, pressure on the lungs from the outside, etc. It is subject to individual variations and varies even in the same individual (menstruation, puberty, etc.). The well known curved outline of a pleuritic exudate as seen on the x-ray film (Ellis-Damoiseau's line) is the resultant of gravity and of active retraction of the lower lobe.

In the clinical search for atelectasis, the x-ray examination is undoubtedly the most valuable procedure, but one must not always expect to find a deep frosted glass-like cloudiness. Only in tumors does one often find complete obstruction of the bronchus causing such a dense shadow. In tuberculosis there is mostly only a narrowing of the bronchial lumen (for instance through scar contraction of the bronchus) producing a diminished air content of the section involved. Secondary characteristics of aid in reaching a diagnosis are elevation of the diaphragm, displacement of the mediastinum, narrowing of the intercostal spaces, compensatory emphysema of the adjoining section of lung, etc. Of great importance is the fluoroscopic examination, which in the case of a narrowing of the bronchus will show a movement of the mediastinum toward the affected side on inspiration and toward the opposite side on expiration. Sometimes, however, even these characteristic pendulum-like movements of the mediastinum may be absent, due to rigidity of the mediastinal structures. Then a bronchoscopy is to be done. Bronchography with iodized oil is often helpful but is not without danger in cases of tuberculosis. Planigraphy may give valuable information and should frequently be resorted to.

The ultimate outcome of atelectasis may be complete re-expansion, occurring even after years. However, if inflammatory processes have destroyed the epithelial lining of the alveoli, scars and induration will develop. If there is a persistent stricture of the bronchus, the inevitable retention of secretion will eventually often lead to atelectatic bronchiectases.

In tuberculosis, an atelectasis may be caused through compression of the bronchus by enlarged hilar lymph nodes, perforation of a lymph node into the bronchus, hemorrhage, scar contraction of the lungs producing kinking of the bronchus, scar contraction of the bronchus itself producing stenosis, cavitation, etc.

Isolated tuberculosis of a large bronchus is clinically characterized by a one-sided bronchitis, a persistently positive sputum, and a practically negative x-ray film. The early diagnosis, usually made by bronchoscopy, is extremely important so that chemotherapy may be instituted to prevent a stenosis. Once a marked stenosis has occurred, the treatment of choice is lobectomy.

The etiology, the roentgenologic diagnosis, and the treatment of atelectasis are illustrated by means of numerous case records.

Sixty-three roentgenograms; 6 drawings.

WILLIAM A. MARSHALL, M.D.
Chicago, Ill.

Congenital Lobar Emphysema. Ross Robertson and E. Stewart James. Pediatrics **8**: 795–804, December 1951.

The authors report 5 cases of regional emphysema of congenital origin occurring in infancy, involving an entire lobe. In these cases inflammation was not an etiologic factor. The bronchial obstruction appeared to be due to folds of mucosa or weakness of the bronchial wall forming a check-valve mechanism.

When an infant, previously well, begins to have attacks of dyspnea and cyanosis, congenital lobar emphysema should be considered. Roentgenograms of the chest may at first glance suggest other conditions, such as congenital heart disease, atelectasis, interstitial emphysema with spontaneous pneumothorax, agenesis of a lung, congenital tension cyst, regional obstructive emphysema, foreign body in a bronchus, and diaphragmatic hernia or eventration.

Congenital heart disease can be excluded by the finding of gross displacement of the mediastinum and the alteration of the breath sounds over the emphysematous lobe. Cardiac murmurs and alterations in cardiac outline are absent.

Atelectasis of a lobe or lung will cause retraction of the mediastinum, but the diaphragm will be elevated rather than depressed as in emphysema. The atelectatic lung will appear more radiopaque than the lung compressed by an emphysematous lobe and finally, although the air-containing lung opposite the atelectasis may be over-expanded, it has not the ballooned translucent appearance of an emphysematous lobe.

Interstitial emphysema with spontaneous pneumothorax is the result of violent respiratory efforts, as in asthma, aspiration of food, pressure anesthesia, or resuscitation. Surgical emphysema may be palpable in the neck. Roentgenograms will show interstitial emphysema in the mediastinum and the lung collapsed at the hilus rather than crowded into the apex and costophrenic and cardiophrenic angles by the emphysematous lobe.

In agenesis of a lobe or lung there is complete absence of bronchial or lung markings and the diaphragm is elevated.

Congenital tension cysts usually cast definite annular shadows in the roentgenogram.

Regional obstructive emphysema is associated with bronchitis and viscid secretions obstructing the lumen as a check-valve. The presence of fever and other signs of infection will differentiate this condition from congenital lobar emphysema.

Foreign body in a bronchus can usually be excluded by a careful history and by bronchoscopy.

Herniation or eventration of the diaphragm is usually obvious in the roentgenogram. A barium swallow will settle any doubt.

Infants stand lobectomy surprisingly well, and 3 of the authors' patients in whom this procedure was performed are now apparently perfectly healthy. In the untreated case the prognosis is hopeless.

Five roentgenograms; 3 photomicrographs; 2 photographs.

Pre-Bronchiectasis. H. B. Harwood. M. J. Australia **2**: 258–264, Aug. 25, 1951.

A plea is made for early and adequate bronchoscopic drainage in so-called "prebronchiectasis." This latter term is used by the author to designate those respiratory infections in which areas of atelectasis may develop from aspiration of tenacious sputum. In some the history is suggestive of bronchiectasis but bronchograms are negative; others show slight dilatations or crowding of the bronchi. It is claimed that these minimal changes can revert to normal if treatment is adequate.

The author discusses 50 cases in which he believes irreversible bronchiectasis would have developed if bronchoscopic drainage had not been instituted. [Obviously such a statement cannot be proved or disproved, but whether or not there is such an entity as "prebronchiectasis," the principle of clearing obstructed bronchi is a sound one.] ZAC F. ENDRESS, M.D.
Pontiac, Mich.

The Prognosis of Residual Bronchiectasis After Incomplete Resection. George P. Rosemond, W. Emory Burnett, and Joan Humphrey-Long. J. Thoracic Surg. **22**: 439–447, November 1951.

From 1936 through 1949, pulmonary resection was done in 194 patients with bronchiectasis in Temple University Hospital (Philadelphia). Follow-up studies over periods of one to fifteen years were conducted in 159 of these. Residual disease was found in 55 of this number. Fourteen of these were symptom-free.

The authors lay special stress on the performance of bronchography as a preliminary to operation. Complete surgical removal of all bronchiectatic lung is necessary to insure remission of symptoms of cough and expectoration. Since the extent of involvement cannot be reliably evaluated at operation, preoperative bronchography is essential, and the findings must be accurate. Because iodized oil is so slowly absorbed as to render immediate re-examination practically invalid, the initial mapping of the bronchi should be complete. The presence of secretions and other factors which interfere with satisfactory mapping must be controlled.

Bronchiectasis does not shorten life, and the prime argument for surgery is to alleviate symptoms. Even incomplete removal of involved lung tissue is beneficial in this respect in some patients, and palliative resection is justified.

Twenty-one bronchograms; 1 drawing; 6 tables.
DONALD DEF. BAUER, M.D.
St. Paul, Minn.

The Radiology of Acute Pulmonary Œdema. Frederic Jackson. Brit. Heart J. **13**: 503–518, October 1951.

The radiologic features of acute pulmonary edema were studied by the author in 20 cases, 14 due to left ventricular failure and 6 to mitral stenosis. The typical radiologic appearance was cloudy granular opacities radiating from the hili and sparing the most peripheral portions of the lungs, usually with clear costophrenic angles. No case of unilateral opacities was observed in this series, though the abnormal shadows were not necessarily symmetrical.

The shadowing often takes one of two forms, a dense cloudy or blotchy appearance or, less commonly, a blurred speckling or branching with a generalized loss of translucency of the lung fields; pinhead stippling in the outer part of the shadowing was seen in one teleradiogram and recurred in subsequent attacks.

Hydrothorax is unusual unless there is added right ventricular failure or pulmonary infarction.

Rapid disappearance of the roentgenographic changes is the rule, sometimes occurring in less than twenty-four hours; this finding serves to differentiate edema from infiltration or infarction.

Acute pulmonary edema in uremic patients is the result of left ventricular failure; it does not seem to result from uremia without failure.

In mitral stenosis acute pulmonary edema occurs mostly in women and nearly always with normal rhythm. The lung opacities disappear rapidly with treatment so that they are often missed. Cardiac enlargement is frequently slight but hilar congestion tends to be severe. During the later months of pregnancy there seems to be an increased predisposition toward acute pulmonary edema in women with mitral stenosis.

Thirty roentgenograms; 1 photograph.
RICHARD A. ELMER, M.D.
Atlanta, Ga.

Roentgen Kymographic Differential Diagnosis of Pulmonary Congestion and Pulmonary Hyperemia. P. Thurn. Fortschr. a. d. Geb. d. Röntgenstrahlen **75**: 406–415, October 1951. (In German)

By means of x-ray kymography it may be possible to differentiate between pulmonary congestion and pulmonary hyperemia. In pulmonary congestion, as a rule, a differentiation between arteries and veins is kymographically impossible, and only associated or concomitant movements of the vascular margins can be registered. On the other hand, in pulmonary hyperemia the larger pulmonary arteries often show concentric pulsatory changes in the width of the arterial lumen. This observation presupposes an adequate pulsatory variation in the volume of a dilated elastic artery; simple pressure increase due to rise of peripheral resistance (without greater amplitude) is not sufficient to cause this phenomenon.

Fourteen kymograms. ERNST A. SCHMIDT, M.D.
Denver, Colo.

Traumatic Lung Carcinoma: Contribution to the Pathology of Cicatricial Carcinoma of the Lung. J. Dahlmann. Fortschr. a. d. Geb. d. Röntgenstrahlen **75**: 628–635, November 1951. (In German)

Pulmonary carcinoma arising on the basis of scar tissue is not frequently observed. The scar tissue may be a result of tuberculosis, especially rupture of a tuberculous node or subpleural tuberculous lesion, silicosis, infarction, etc. Very few cases have been observed on the basis of trauma. The author cites the first case definitely recognized as attributable to a gunshot

wound, reported in 1941 by Kalbfleisch (Frankfurt. Ztschr. f. Path. **55**: 220, 1941). Twenty-five years after the injury a small-cell bronchial carcinoma developed along the tract of the missile.

The author's own patient was a 64-year-old man with no previous or family history of carcinoma. A shrapnel splinter had entered his right lung in 1918. Thirty-two years later he complained of pain in the affected area, with cough, expectoration and mucus, and loss of weight and appetite. The projectile was seen on an x-ray film, surrounded by an irregular dense area. The patient's course was rapidly downward. Autopsy revealed a mass the size of an egg, with cavitation, and the metallic foreign body. The histologic diagnosis was small-cell carcinoma in old scar tissue.

The author considers the autopsy findings absolute proof of an etiological relationship between the trauma, resulting scar tissue formation, and proclivity to later carcinoma (regenerative theory of Fischer-Wasels).

Four roentgenograms; 1 photomicrograph; 1 photograph.

E. W. SPACKMAN, M.D.
Fort Worth, Texas

Asbestosis Associated with Bronchogenic Carcinoma. Roger Stoll, Richard Bass, and Alfred A. Angrist. Arch. Int. Med. **88**: 831–834, December 1951.

A case of bronchogenic carcinoma in association with pulmonary asbestosis is presented. A review of the literature indicates that bronchogenic carcinoma may be present in from 7.5 per cent to 50 per cent of patients with asbestosis. This is much higher than the incidence of pulmonary carcinoma in the general adult population.

In regard to the mechanism of the malignant change, it is questionable whether the silicate in asbestosis is itself directly carcinogenic or whether it causes bronchiectasis with metaplasia, due to irritation of the bronchial epithelium, and so leads to carcinoma. The former mechanism seems significant, since this high incidence of carcinoma does not occur in other forms of silicosis, although these tend to produce an equivalent degree of bronchitis and bronchiectasis.

HOWARD L. STEINBACH, M.D.
University of California

Pulmonary Tuberculosis, Bronchiectasis, and Calcification as Related to Bronchogenic Carcinoma. C. Eugene Woodruff and Hector C. Nahas. Am. Rev. Tuberc. **64**: 620–629, December 1951.

In an attempt to determine whether or not pulmonary calcification and bronchogenic carcinoma are closely associated, 1,144 autopsy reports from a tuberculosis sanatorium were reviewed, revealing 15 cases of primary cancer of the lung. In addition, 4 cases of bronchogenic carcinoma diagnosed following bronchial biopsy and 4 cases diagnosed following lobectomy or pneumonectomy are included in the study.

Of the total of 23 cases, 12 were squamous-cell carcinoma, and of these, 11 were associated with a calcified pulmonary focus. Only 3 of 9 undifferentiated tumors were associated with calcification, and no calcification was noted in the 2 adenocarcinomata. Positive cultures were obtained in only 2 cases with squamous-cell lesions, but were found in 3 of the 9 undifferentiated and in 1 of the 2 adenocarcinomata. All of the squamous-cell lesions were in the upper lobes.

It is possible that the neoplasms arise in areas of bronchiectasis which have resulted from tuberculosis and in which squamous-cell metaplasia has preceded the development of carcinoma. Calcified parenchymal or hilar lesions then may indicate an area of lung which is susceptible to tumor formation in some of these patients. The authors also suggest that a combination of local bronchiectasis following tuberculosis plus long continued smoking may render an individual particularly likely to develop a lung carcinoma of the squamous-cell type.

Six roentgenograms; 3 photomicrographs; 1 table.

JOHN H. JUHL, M.D.
University of Wisconsin

Development of Pulmonary Tuberculosis After Pleurisy. A. Wernli-Haessig. Schweiz. med. Wchnschr. **81**: 1080–1085, Nov. 3, 1951. (In German)

Swiss statistics show that in 16 per cent of 569 military patients coming to the hospital with pleurisy pulmonary tuberculosis later developed, while a fourth of the patients seen with pulmonary tuberculosis gave previous history of pleurisy.

The author presents 6 case histories to show that the first pulmonary focus usually develops within two years after the pleurisy. In the interim the patients are usually well and symptom-free, with a normal blood sedimentation rate. Because the development of the tuberculosis occurs without symptoms, it is thought that all patients with pleurisy, primary pulmonary tuberculosis, and erythema nodosum should undergo regular observation by means of fluoroscopic examination and x-ray films. The author recommends that films be made after the first, third, sixth, and tenth months, and then subsequently at six-month periods for three years. Following this, films may be obtained annually.

Thirty-seven roentgenograms.

ILONA D. SCOTT, M.D.
VA Hospital, Chamblee, Ga.

Intensive X-Ray Survey for Tuberculosis in a Rural County. Waldo R. Oechsli, H. Cohn, C. R. Kroeger, and A. A. Adames. California Med. **75**: 341–344, November 1951.

In a concerted drive to survey the populace of Imperial County, a rural area in southern California, with a population of about 63,000, approximately 38,000 miniature films were taken in about seven weeks. This represented about 73 per cent of the residents over fifteen years of age. A high-pressure publicity campaign was carried out preceding and during the survey, using every available medium of publicity. The state and county health organizations and local committees cooperated to make the drive a success.

Of the total number who had miniature films, 68 were ultimately reported as having active pulmonary tuberculosis. This amounted to one case for every 505 persons covered by the survey. Only 4 of these cases were previously known to the Health Department. The cost of the survey was $30,230.46. The total cost per person covered was 80 cents, the cost of finding each of the 68 reported cases of active tuberculosis was $444.58, and the cost per patient hospitalized was $530.36.

In addition to finding the previously unrecognized cases of tuberculosis, the survey made other gains. An increased interest in tuberculosis control was created in

the community, and the need for more careful investigation of the state of health of the Mexican workers who daily pour into Imperial County to work was made apparent. A spot check of 2,556 miniature films was made in a town near the California-Mexico border. In 4 per cent of the films of Mexico residents, abnormalities consistent with tuberculosis were noted, compared with 2.4 per cent in residents of California.

Four tables. BERTRAM LEVIN, M.D.
Minneapolis, Minn.

Floating of the Lung in Free Pleural Effusion. Enrico Lattanzio. Radiol. med. (Milan) **37**: 917–925, November 1951. (In Italian)

This is a study of the displacement of the lung produced by free pleural effusions and of the relationship of the floating lung to the fluid after changes in the position of the patient. The author points out the best positions and projections for the demonstration of small amounts of fluid and explains that the fluid may be more apparent in the roentgenograms during expiration. This is because, during expiration, the capacity of the hemithorax is diminished and there is an increase in the thickness of the fluid layer accompanied by a decrease in the volume of the lung.

The author also points out that the pulmonary compression and atelectasis which occur in the presence of free fluid are more marked in the lower portions of the lung because of the higher hydrostatic pressures.

This otherwise excellent article fails to mention that change in the position of the patient may shift the fluid away from parenchymal processes and uncover unsuspected lung lesions.

Five roentgenograms; 4 drawings.
CESARE GIANTURCO, M.D.
Urbana, Ill.

Platinosis. A Five-Year Study of the Effects of Soluble Platinum Salts on Employees in a Platinum Laboratory and Refinery. A. Eaton Roberts. Arch. Indust. Hyg. & Occup. Med. **4**: 549–559, December 1951.

The author defines platinosis as the effects of soluble platinum salts on persons exposed to them occupationally. In his experience the etiologic agent for platinosis has been chiefly the complex platinum ion contained in soluble salts, notably sodium chloroplatinate, the mode of entry being inhalation and direct contact with sprays containing the salt in solution.

The incidence of platinosis was considered to be 100 per cent of the employees in the Pennsylvania refinery and laboratory covered in the author's survey. Sixty per cent of the employees were symptomatic; the other 40 per cent were allegedly free from symptoms but exhibited the same inflammatory changes in the conjunctivae and mucous membranes of the upper respiratory tract, with hypertrophy of the mucosa of the turbinates and of the lymphatic tissue in the throat, and the same constant relative lymphocytosis, as were observed among the symptomatic group.

During the past five years, 21 employees were studied. Eight of these were examined each year, while the others were examined prior to employment and each year that they remained in the refinery. Chest roentgenograms were taken routinely every year. In 4 employees there was roentgen evidence of emphysema; in 12, thickening of the hilar areas; in 16, increased bronchovascular markings; in 1, an enlarged cardiac pulmonic conus, and in 2, diffuse pulmonary fibrosis. These findings suggest a natural extension of the irritative inflammatory changes visualized in the nose and throat, producing a low-grade pulmonary fibrosis. No carcinogenic activity has been attributed to the complex salts of platinum, nor has pulmonary tuberculosis been observed.

Prophylactic treatment of platinosis includes careful selection of employees in order to exclude allergy-prone individuals, clean uniforms daily, and the use of skin protectants. The best active treatment for symptomatic platinosis, quite naturally, is the removal of the victim from the platinum atmosphere. Hyposensitization was attempted in 1 case, experimentally, with beneficial results.

Three tables.

Note on the Experimental Transmission of Histoplasmosis by Pulmonary Pathway. P. Fréour and Claveleau. J. franç. méd. et chir. thorac. **5**: 578–583 1951. (In French)

Suspensions of the yeast form of *Histoplasma capsulatum* were injected intratracheally into guinea-pigs and dogs. The results seem to indicate that histoplasmosis may be transmitted by the pulmonary passages. A pneumonic process is produced followed by systemic dissemination with the production of numerous lesions in the liver, spleen, and lymph nodes. The pathogenic fungus is evacuated by the air pathways, by the feces (probably through bile), and occasionally is found in the urine.

Two figures; 2 tables. CHARLES M. NICE, M.D.
University of Minnesota

Large Staphylococcal Pulmonary Bullae in an Infant of Five Years. André Meyer, J. M. Lemoine, and J. Peltier. J. franç. méd. et chir. thorac. **5**: 560–562, 1951. (In French)

A 5-year-old child was seen with upper respiratory infection of long standing, accompanied by fever and cough with production of thick sputum, which had not responded to penicillin. A chest film showed a poorly isolated cavity 3 cm. in diameter in the right lower lobe. Bacterial studies revealed a *Staphylococcus aureus* organism sensitive to Aureomycin and Terramycin. On a dosage of 1 gram of Aureomycin per day for five days the cavity increased to 9 cm. in diameter and clinical symptoms persisted. After institution of combined Aureomycin and Terramycin therapy, the clinical state improved in a few days and the cavity disappeared. It was attributed to bullous distention produced by inflammatory bronchial obstruction.

CHARLES M. NICE, M.D.
University of Minnesota

Adenoma of Bronchus in a Nine-Year-Old Child. Saul Smoller and Aubre De L. Maynard. Am. J. Dis. Child. **82**: 587–592, November 1951.

Since this entity in the pediatric age group is rare, a case of bronchial adenoma in a 9-year-old Negro girl is presented.

The child was first seen with a history of chronic cough and recent hemoptysis. A roentgenogram showed an area of density involving the greater part of the middle lobe of the right lung, and a biopsy specimen, obtained through the bronchoscope, was interpreted as

chronic inflammatory tissue. Eight months later the patient was again seen with a history of continued cough and repeated hemoptysis. There was a recurrence of the middle lobe density, which had previously cleared. A polypoid mass was removed bronchoscopically and a diagnosis of bronchial adenoma was made. Symptoms persisted, however, and pneumonectomy was eventually performed, revealing enlarged peribronchial lymph nodes, bronchostenosis, and chronic suppurative lung changes, though there was no evidence of the primary tumor.

Because of the ability of bronchial adenomas to metastasize via the blood and lymph streams and by local extension, their early recognition and removal are emphasized. Treatment may be conservative, with radon seed implantation, electrocoagulation, forceps removal, or a combination of the above methods. Radical treatment with surgical extirpation by lobectomy or pneumonectomy is preferred .

Four roentgenograms; 1 photomicrograph.

LAWRENCE A. PILLA, M.D.
University of Louisville

An Anomalous Tracheal Bronchus to the Right Upper Lobe. Charles E. Gerson and Emil Rothstein. Am. Rev. Tuberc. **64**: 686–690, December 1951.

A case of anomalous supernumerary bronchus to the right upper lobe is reported. It arose from the right lateral aspect of the trachea approximately 5 cm. above the carina and was demonstrated on bronchography. The usual three segmental branches of the right upper lobe bronchus were identified in addition to the anomalous branch.

At earlier bronchoscopy the patient was thought to have stenosis of the right main bronchus, but further study proved the "stenotic" bronchus to be the anomalous branch.

Two roentgenograms.

JOHN H. JUHL, M.D.
University of Wisconsin

Heart Disease Case Finding by Means of 70 mm. Photofluorographic Films. Group I. David D. Rutstein, Charles R. Williamson, and Felix E. Moore. **Group II.** Charles R. Williamson, Felix E. Moore, and David D. Rutstein. Circulation **4**: 641–651; 652–658, November 1951.

The cases on which these two papers are based were drawn from a mass survey conducted in Boston from September 1949 to January 1950, in which 536,000 70-mm. photofluorographic films were taken. Group I included films for 31,091 persons, which after having been read by the U. S. Public Health physicians (designated as "regular readers") were re-read by radiologists with special reference to the heart and great vessels. The films in Group II were read only once for all possible chest abnormalities and are thus more representative of the usual mass survey.

All cases considered to show heart disease in each group, as well as any that were suspicious, received further study, including physical examination by cardiologists, electrocardiograms, and other examinations as indicated.

In Group I, the radiologists classified three times as many films as showing an abnormal cardiac silhouette as did the "regular readers." Altogether 1,101 films (3.54 per cent) were classed as abnormal. Eight hundred and forty-five patients returned for further examination and in 504 heart disease was verified (45.8 per cent of those with films described as abnormal).

In Group II the over-all percentage of abnormal films was only 0.41 per cent and heart disease was verified in 233 of 309 persons reporting for further observation (56.8 per cent of those with abnormal readings).

More abnormal hearts were found in females than males and in non-whites than in whites.

[The obvious conclusion to be drawn is that a significant number of cases of heart disease will be overlooked in mass surveys unless an additional reading is made by a radiologist.]

Nine tables.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Screening Tests in Mass Surveys and Their Use in Heart Disease Case Finding. David D. Rutstein. Circulation **4**: 659–665, November 1951.

Any screening test used in mass surveys must be *reliable, i.e.*, the technical features must be such that technicians of average training can obtain reproducible results; the results of the test on the same individual at different times must be similar within a narrow range of experimental error; finally, properly qualified personnel must be available to interpret the results.

The test must also be *valid*, a factor which is measured by the accuracy with which the true positives and true negatives are segregated, and the smallness of the number of false positives and false negatives.

Analysis of the results of the two Boston heart disease studies described in the preceding abstract convinces the author that 70-mm. photofluorography is both reliable and valid as a heart disease case-finding procedure in mass surveys. The majority of those reported to have heart disease were found to have significant lesions on follow-up examination. No funds were available to make a corollary check on a sample group reported as negative.

The yield of the survey was considered satisfactory in Group I; that is, the number of cases benefited by referral for heart disease as well as those who found that they did not have heart disease but thought that they did before the survey.

The cost of the survey could not be accurately measured, since it was primarily a tuberculosis case-finding survey and much of the cost was properly attributed to that aspect. [It seems likely that heart disease cases will continue to be a by-product of mass chest surveys rather than the object of the screening until tuberculosis becomes a much more rare disease than at present. Z. F. E.]

Co-operation of the professional groups and agencies was good, and the general public accepted the idea of the survey, since more than three-fourths of those requested to return for diagnosis did so. On the whole, the author concludes that the results justify the use of 70-mm. photofluorographic film for heart disease case-finding.

Two drawings.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Roentgenographic Findings in Congenital Tricuspid Atresia with Hypoplasia of the Right Ventricle. Martin H. Wittenborg, Edward B. D. Neuhauser, and William H. Sprunt. Am. J. Roentgenol. **66**: 712–727, November 1951.

This is a discussion of the roentgen findings in congenital tricuspid atresia with a detailed study of 11

patients, divided according to the roentgenographic appearances. The hearts fell into three groups: (*a*) "characteristic" or "specific" appearance; (*b*) "coeur en sabot" appearance; (*c*) "coeur en sabot" with dextrocardiac appearance.

The characteristic roentgen appearance of tricuspid atresia was observed in only 2 patients. This includes diminished convexity, or actual concavity, of the lower right border of the cardiac silhouette in the postero-anterior projection and of the anterior border in the left anterior oblique view; narrowing of the waist of the heart; prominence of the left heart border in the postero-anterior view, with failure to clear the spine in the left anterior oblique position; diminished prominence of the peripheral pulmonary vascular markings, constituting direct evidence of reduced pulmonary blood flow.

In 5 cases the heart had the "coeur en sabot" appearance resembling the tetralogy of Fallot, and in 4 cases the appearance was that of dextrocardia without situs inversus, with a configuration similar to if not identical with that of a "mirror image" of Fallot.

Among the roentgen features which are of importance in determining the operability in a given case of tricuspid atresia are the size of the right auricle, which is of significance in judging the functional size of the auricular septal defect, and the pulmonary vascular markings, which are the radiologist's main clue to the state of the pulmonary blood flow.

Increased vascularity of the lung fields with or without hilar dance almost invariably indicates partial transposition of the great vessels in tricuspid atresia. Present surgical technics may be directed toward the enlargement of the auricular septal defect, if this is the probable limiting factor, or the creation of an additional left-to-right shunt to increase the pulmonary blood flow if this is the primary handicap.

The practical problem so far as differential diagnosis is concerned resolves itself into the differentiation of the tetralogy of Fallot from tricuspid atresia without transposition of the great vessels. The few tricuspid atresias with the specific appearance offer no difficulty. In the remainder the electrocardiogram may offer the only differential clue.

Twenty roentgenograms; 3 drawings; 4 tables.

A. WILSON BROWN, M.D.
Shreveport (La.) Charity Hospital

Roentgen Cinematographic Demonstration of Tricuspid Atresia. R. Janker and H. Hallerbach. Fortschr. a. d. Geb. d. Röntgenstrahlen **75**: 393–406, October 1951. (In German)

According to the authors, four different types of apparatus are available at the present time in Germany for angiocardiographic examinations: (1) a hand-operated apparatus with which six 24 × 30-cm. films may be obtained within seven or eight seconds; (2) a roll-film apparatus for one to six and a half exposures per second, with 30 × 30-cm. films in different planes; (3) an apparatus for the production of medium-sized fluoroscopic pictures at intervals of 0.7 to 0.8 second; (4) an apparatus for indirect x-ray cinematography by which 18 to 24 pictures can be made per second on ordinary 35-mm. film.

The last of these methods (angiocardiocinematography), which makes it possible to visualize without interruption the complete filling process of the heart and great vessels, is considered far superior to the other procedures in the diagnosis of congenital heart disease. The authors base their conclusions on their experience with 370 x-ray cinematographic examinations in general and with 13 children suffering from atresia of the tricuspid valve in particular. X-ray cinematography is recommended as the method of choice not only for its diagnostic possibilities and simplicity of application but also for its economy. It is equally adaptable for cerebral and peripheral angiography, for studies of the gastrointestinal tract and the urogenital system.

The typical cardioangiographic appearance of the heart in tricuspid atresia is described and illustrated by numerous enlargements from cinematographic films.

Fifty-eight roentgenograms; 2 drawings; 1 chart.

ERNST A. SCHMIDT, M.D.
Denver, Colo.

Ebstein's Disease: Report of the First Case Diagnosed During Life. Louis A. Soloff, Herbert M. Stauffer, and Jacob Zatuchni. Am. J. M. Sc. **222**: 554–561, November 1951.

Ebstein's disease is a congenital malformation of the heart characterized by a downward displacement of an anomalous tricuspid valve that divides the right side of the heart into a large auricular portion consisting of the true auricle and the greater portion of the ventricle and a smaller ventricular portion consisting of the lower portion of the ventricular cavity with its outflow tract.

The subject of the present case report was a 34-year-old white woman seen in January 1951 for hypertension, first discovered in February 1949, when hemorrhage in the right eye occurred and evidence of mild cardiac failure developed. When seen by the authors, the patient had a blood pressure of 220/160 and complete right optic atrophy. The cardiac findings, however, were unusual for hypertension. There were a systolic thrill and murmur in the third intercostal space parasternally. Radiographic studies revealed a huge cardiac silhouette. The left ventricle appeared enlarged, but there was also evidence of a greatly enlarged right atrium. The electrocardiogram showed a right bundle branch block with giant P waves in the right precordial leads. The right heart circulation time was prolonged and there was arterial oxygen unsaturation. Other observations included a mild polycythemia and impairment of kidney function. It was felt that the patient had both hypertension on the basis of chronic renal disease and a congenital abnormality.

Angiocardiography, with simultaneous exposures at right angles, demonstrated an enlarged right atrium and what was interpreted as an "auricularized" right ventricle. There also appeared to be an interatrial septal defect. In the later exposures a narrow band of contrast was seen in the most anterior portion of the heart, in the right anterior oblique view, pulsating actively but remaining constantly separated from the adjacent contrast-filled chamber by a narrow band which was never opacified. The former is thought to represent the functioning portion of the right ventricle and the latter the separation between its inferior tip and the anterior aspect of the "auricularized" right ventricle. Electrokymographic studies were indicative of tricuspid insufficiency.

Ten roentgenograms; 7 drawings; 1 electrocardiogram.

PAUL W. ROMAN, M.D.
Baltimore, Md.

Diverticulum of the Left Ventricle of the Heart. Review of the Literature and Report of a Successful Removal of the Diverticulum. Samuel Skapinker. Arch. Surg. **63**: 629–634, November 1951.

The diagnosis of a diverticulum of the heart should be borne in mind in every infant with a pulsating swelling in the region of the umbilicus. Twelve cases were found in the literature, the present report bringing the number to thirteen. In the majority of these cases the long, finger-like diverticulum of the apex of the left ventricle passed down through the diaphragm, through a parasternal hiatus, into the anterior abdominal wall, usually just anterior to the peritoneum.

The author's patient, a female Bantu child, aged two months, had a pulsating expansile tumor at the umbilicus which, according to the mother, had been present since birth. A pulse wave could be seen passing upward. The tumor passed up slightly to the left of the mid-line under the costal margin. A "to-and-fro" murmur could be heard over it and a systolic murmur over the precordium.

An angiogram obtained following direct injection of the medium into this pulsating mass demonstrated the dye passing upward directly into the left ventricle. At operation the mass was found immediately anterior to the peritoneum, passing directly upward through a defect in the diaphragm, and communicating with the left ventricle. The serous cavity that held the diverticulum was in direct communication with the pericardial sac. The diverticulum was severed at its base and the pedicle ligated. The child has remained well since.

The origin of a diverticulum of the left ventricle is best explained as a congenital defect. Although the average thickness of the wall of the left ventricle is approximately 13 mm., the apex of the left ventricle has an average thickness of only 2 mm. It is felt that increased intracardiac pressure may lead to a "blow-out" at this thin apex with formation of the diverticulum. This must occur before the final development of the diaphragm, as in the majority of cases described the diverticulum passes through a parasternal hiatus.

Three angiograms; 2 sketches; 1 photograph; 1 table.

ALFRED O. MILLER, M.D.
Louisville, Ky.

Ventricular Aneurysm in a 29-Year-Old Man Studied Angiocardiographically. Cyril H. Dolly, Charles T. Dotter, and Israel Steinberg. Am. Heart J. **42**: 894–899, December 1951.

Aneurysm of the anterolateral wall of the left ventricle follows approximately 9 per cent of myocardial infarctions. The occurrence of calcification in the aneurysm wall is not uncommon, nor is thrombus formation within the sac. An aneurysm may develop at any time from a week to several years following infarction, the average period being seventeen and a half months in one reported series (Parkinson *et al.*: Quart. J. Med. **7**: 455, 1938). Two-thirds of cardiac aneurysms occur in males.

A case is presented of a 29-year-old Negro male who complained of exertional dyspnea and dull precordial pain. Chest roentgenograms showed a localized, rounded shadow contiguous with the anterolateral wall of the left ventricle. The periphery of the mass contained faint calcific deposits. Paradoxical pulsation was observed fluoroscopically and demonstrated by roentgenkymography. An electrokymogram showed marked systolic expansion. Electrocardiography revealed evidence of previous myocardial infarction.

Angiocardiography was performed, a frontal film being exposed ten and a half seconds following the intravenous injection of 45 c.c. of 70 per cent Neoiopax. The aneurysmal cavity was demonstrated arising from the left ventricle anteriorly.

The angiocardiogram reveals little difference between small ventricular aneurysms and the appearance of the left ventricle following massive myocardial infarction. In the latter case, the ventricle appears as if in perpetual diastole.

Three roentgenograms; 1 drawing; 2 electrocardiograms.

HOWARD L. STEINBACH, M.D.
University of California

The Heart in Generalised Scleroderma. Progressive Systemic Sclerosis. R. H. Goetz. Angiology **2**: 555–578, December 1951.

Scleroderma is only the obvious and striking symptom of a generalized disease, the most serious symptoms of which arise in the viscera. In the present paper the author concentrates entirely on the cardiac manifestations of this condition. In addition to the generalized scleroderma and heart lesions each of the 3 cases reported also exhibited calcinosis cutis, Raynaud's phenomenon, other visceral lesions, particularly in the gastrointestinal tract, and involvement of the skeletal musculature.

In the experience of the author, cardiac involvement usually occurs late in the course of scleroderma. Clinically all of his patients suffered from dyspnea, orthopnea, and eventually became cyanotic. One of them presented the picture of a "black cardiac." The cyanosis, however, was not cardiac in origin in any instance, but was part and parcel of the involvement of the lungs. A constant feature in these cases was a progressive fall in blood pressure as the disease progressed. The kymogram in all 3 cases showed definite blunting of the excursions and in 1 case the heart movements were practically absent. In 2 of the 3 cases the heart was reported as small, weighing less than normal despite hypertrophy of the heart muscle.

Histologically, there is found to be an overgrowth of the heart muscle by connective tissue similar to the process seen in the skin in these cases. The heart muscle itself does not appear to be involved, but only to disappear by secondary degeneration. The author believes that the association of scleroderma and the heart lesion is not fortuitous, but that the cardiac pathology is a typical manifestation of that progressive sclerosing condition of which scleroderma is but one other sign.

Seven roentgenograms; 4 electrocardiograms; 5 photographs; 13 photomicrographs.

Radiological Visualization of the Coronary Sinus and Coronary Veins. Giulio Tori. Acta radiol. **36**: 405–410, November 1951.

The author describes a technic for catheterization of the coronary sinus and the roentgen visualization of the coronary sinus and coronary veins after injection of an opaque medium.

A catheter is introduced into the right auricle under fluoroscopic guidance. The patient is placed in the right anterior oblique position and the tip of the catheter is directed toward the tricuspid valve, but, in-

stead of being pushed downward in an attempt to pass it beyond the valve, the catheter is rotated slightly in order to direct it toward the posterior wall of the auricle. After several attempts, the catheter is seen to enter the coronary sinus. It is then arrested at the posterolateral border of the heart and there is no visible space between the outer surface of the heart and the tip of the catheter.

Two illustrative cases are reported.

Three roentgenograms; 2 drawings.

RODERICK L. TONDREAU, M.D.
University of Pennsylvania

Angiocardiography in Obstruction of the Superior Vena Cava. Harold J. Jacobs, Louis Levy, II, Harold Chastant, and Howard Strauss. J. A. M. A. **147:** 1051–1052, Nov. 10, 1951.

Angiocardiographic visualization of the cardiac chambers in cases of superior vena cava obstruction cannot be obtained by the usual route of injection through the antecubital vein. The authors therefore utilize the saphenous vein for injection. They describe two cases in which this technic was used.

Five roentgenograms.

EDWARD B. SINGLETON, M.D.
University of Michigan

Visible Pulsation in Relation to Blood Flow and Pressure in the Pulmonary Artery. Maurice Campbell. Brit. Heart J. **13:** 438–456, October 1951.

The size of the right pulmonary artery and the degree of visible pulsation in this vessel have been classified in four grades in various types of congenital heart disease and in mitral stenosis. They have been compared with the pulmonary blood flow and pulmonary arterial pressure as determined by cardiac catheterization. The cases studied included 10 of patent ductus arteriosus, 7 of atrial septal defect, 10 of ventricular septal defect, 6 of Eisenmenger's complex, 4 of primary pulmonary hypertension, 7 of transposition of the aorta and pulmonary artery, and 20 of mitral stenosis.

Pulsation in the right pulmonary artery is greatest in atrial and ventricular septal defect, in Eisenmenger's complex, and in transposition of the aorta and pulmonary artery; it is much less in patent ductus arteriosus and in pulmonary hypertension, and insignificant in mitral stenosis. Pulsation in the peripheral third of the lung and a hilar dance are seen only in septal defects and in transposition, and occasionally in Eisenmenger's complex.

The size of the pulmonary arteries is influenced by increased pressure or by increased flow, and still more when both are increased. Pulsation is visible when there is increased flow, regardless of pressure. In septal defects, increase of pressure has no further effect on pulsation.

A large pulmonary blood flow increases the size of the pulmonary artery and the degree of visible pulsation, whether or not the pulmonary arterial pressure is increased. A high pulmonary pressure without a large flow increases the size of the right and left pulmonary arteries, but has little effect, or none at all, on the degree of visible pulsation, except in Eisenmenger's complex.

Seven roentgenograms; 6 tables.

RICHARD A. ELMER, M.D.
Atlanta, Ga.

Pulmonary Stenosis with Normal Aortic Root. D. Gordon Abrahams and Paul Wood. Brit. Heart J. **13:** 519–548, October 1951.

The authors review 71 cases of pulmonary stenosis with a normal aortic root studied on a basis of careful history taking, detailed physical examinations, and comprehensive electrocardiography and radiography. Cardiac catheterization was carried out in 55 patients, including all doubtful cases. The series comprised 37 cases of simple pulmonary valve stenosis and 8 of simple infundibular stenosis, 15 cases complicated by an arteriovenous intracardiac shunt, 1 case complicated by reversed interventricular shunt, and 8 with reversed interatrial shunt. Two cases of acquired pulmonary stenosis are included.

The incidence of pulmonary stenosis with normal aortic root was 12 per cent of all congenital heart malformations seen over a period of four years, suggesting that this malformation is not as rare as it was formerly thought to be. The clinical features are described in detail, and it is claimed that in uncomplicated cases an accurate bedside diagnosis is nearly always possible.

Severe cases are characterized by effort intolerance peripheral cyanosis, moon facies, small peripheral pulse, giant *a* waves in the jugular venous pulse, presystolic hepatic pulsation, tapping cardiac impulse, parasternal right ventricular heave, impalpable pulmonary artery, high pulmonary systolic thrill and murmur, and single second heart sound. The electrocardiogram shows the P pulmonale and strong right ventricular dominance. Roentgenograms show pulmonary ischemia, poststenotic dilatation of the pulmonary artery, and enlargement of the right ventricle and atrium. Catheterization reveals a mean right ventricular pressure of over 40 mm. Hg and a systolic pressure often well above the systemic pressure. The pulmonary artery pressure is low (2 to 10 mm. Hg). Atrial systole generates a pressure of around 10 mm. Hg. The cardiac output is low and relatively fixed.

Pulmonary valvulotomy was carried out in 10 severe cases. Three patients died, 4 are greatly improved, and 2 recently treated cases are doing well.

Seventeen figures, including 8 roentgenograms; 9 tables.

RICHARD A. ELMER, M.D.
Atlanta, Ga.

Symptomless Pulmonary Arteriovenous Aneurysms or Fistulas. Douglas J. Roberts and J. Elder Hutchison. Am. J. Roentgenol. **66:** 743–746, November 1951.

The author reports a case and reviews the literature on pulmonary arteriovenous aneurysms or fistulas. Some 40 cases have been previously reported. The following findings are noted:

1. The patients are usually young.
2. Cyanosis has been present in all but one of the recorded cases.
3. Clubbing of fingers and toes is usually present.
4. Polycythemia is a constant finding.
5. Symptoms of anoxia predominate (weakness, faintness, dizziness, and dyspnea, and occasional chest pain and hemoptysis), but for the most part the symptoms are those secondary to polycythemia.
6. A continuous murmur has been heard over the tumor in about half of the cases reported.

The authors' case is unusual in that it occurred at an older age period (sixty-six years) than has previously been recorded and that symptoms were minimal. It

tends to show that arteriovenous aneurysms of the lung may exist in the absence of polycythemia or cyanosis.

The roentgen appearance should indicate the diagnosis, especially when laminagraphic studies are included. In the authors' case, roentgenography showed a large, somewhat sacculated appearing density continuous with the hilar vessels in the right lower lobe, with its larger portion toward the periphery. A similar, much smaller vascular enlargement was seen in the right subapical region well outward toward the axillary wall. No definite pulsations were seen in these opacities, but the right hilar structures were observed roentgenoscopically to pulsate much more vigorously than the left. Angiocardiography should be conclusive, and probably should always be employed before submitting the patient to surgery, in order that smaller areas of involvement may not be overlooked.

Four roentgenograms. A. WILSON BROWN, M.D.
Shreveport (La.) Charity Hospital

THE DIGESTIVE SYSTEM

Congenital Tracheoesophageal Fistula Without Esophageal Atresia. Graham Knox. Surgery **30**: 1016–1020, December 1951.

A case of congenital tracheo-esophageal fistula without esophageal atresia but with an adjacent wide-mouthed diverticulum of the esophagus is reported. The patient, a 14-day-old infant, was brought to the hospital in a very dyspneic and slightly cyanotic condition, with a diagnosis of tracheo-esophageal fistula with esophageal atresia. Under fluoroscopic control a catheter was easily passed into the stomach, demonstrating continuity of the esophagus. However, a second, smaller catheter, inserted alongside the first, was seen to lodge in a blind pouch at about the level of the second dorsal vertebra. Lipiodol, introduced into the catheter arrested in the pouch, outlined what appeared to be an esophageal diverticulum projecting to the left of the midline. When the contrast medium had filled the sac, it flowed around the first catheter and entered the stomach, revealing the distal segment of the esophagus to be patent and normal in size. After the catheters had been withdrawn, it was noted that the Lipiodol had entered the tracheobronchial tree. This was attributed to regurgitation and aspiration. No tracheo-esophageal fistula was demonstrated, although examination of the infant was not conducted in the prone position as advocated by Haight (J. Thoracic Surg. **17**: 600, 1948. Abst. in Radiology **53**: 448, 1949).

In the belief that the diverticulum was responsible for the infant's excessive salivation and attacks of choking, dyspnea, and cyanosis, a Stamm gastrostomy was performed. The child remained in poor condition. Serial roentgenograms of the lungs showed progressive atelectasis of the right upper lobe and increasing pneumonitis of the other lobes of the lung. Because of the lung condition, it was felt that operative repair of the diverticulum was indicated. Sixty-one days following the gastrostomy, a second operation was performed. A pouch-like, wide-mouthed diverticulum of the esophagus, which closely simulated the blind upper segment seen in the common type of atresia, was found just to the left of the midline. Further exploration of this area revealed a fistula between the trachea and esophagus, measuring 1.8 cm. in diameter, arising at a point directly opposite the esophageal sac. The fistula entered the posterior wall of the trachea 2 cm. proximal to the carina.

The fistula was divided and the ends closed, and the pouch was partially invaginated. Postoperative chest roentgenograms showed improvement in the lung condition, and barium studies carried out on the thirty-seventh postoperative day proved the esophagus to be patent and unobstructed. A short time later repeat barium studies again showed enlargement of the cervical esophagus, and most of the contrast medium filled the pouch, with only a small portion entering the distal esophagus. The gastrostomy tube was replaced and the child was fed by tube for ten months, with gradual weight gain and general improvement. At the end of that time a third operation was performed and the redundancy of the sac was excised. Follow-up Lipiodol studies and esophagoscopy revealed some angulation of the cervical esophagus in the operative region, but no stenosis or dilatation was noted.

Although this case cannot be classified under any particular category in Ladd's classification, it most closely resembles Type III. Since the esophageal pouch, diagnosed originally as a diverticulum, so closely resembles the proximal blind esophageal segment seen in 90 per cent of the atresia cases, it may be suspected that this child's anomaly represents an arrest somewhat later in the course of development of the esophagus and trachea. The only difference between this case and the classical type of atresia is the persistence of the blind end of the upper segment in spite of actual continuity between upper and lower segments.

Four roentgenograms; 2 drawings.

Early Roentgen Diagnosis in Acute Bleeding from the Upper Gastrointestinal Tract. II. Roentgen Aspects. Max Ritvo, Thomas P. Cotter, and Norman Zamcheck. Am. J. Roentgenol. **66**: 728–741, November 1951.

An investigation was made of 52 patients admitted to the Boston City Hospital with acute bleeding from the upper gastro-intestinal tract. These patients were divided into three groups. Three patients were too ill to stand and were examined only in the recumbent position; in 44 a complete roentgen study was made except for the use of mechanical pressure, and 5 had a complete roentgen study with mechanical pressure. Forty-two per cent of the patients were examined within twenty-four hours of admission; 63.5 per cent within forty-eight hours, and 83 per cent in less than seventy-two hours. Each study was individualized according to the condition of the patient by careful correlation of the clinical data and consultation between the clinician and radiologist. The roentgen findings are summarized as follows, more than one lesion being present in several instances.

	Cases
No demonstrable lesion	9
Esophageal varices	3
Hiatus hernia	6
Gastritis	12
Gastric carcinoma	1
Gastric ulcer	10
Duodenal ulcer	22
Duodenitis	4
Duodenal diverticulum	6
Stomal ulcer	2

The observations are fully described

In conclusion the authors call attention to the importance of early diagnosis of gastric hemorrhage, in view of the recent improvements in gastric surgery and the lowered operative mortality rates. Early roentgen studies may prevent unnecessary laparotomies, reduce time-consuming exploratory procedures, and facilitate surgical therapy.

In a discussion of this paper, Dr. Aubrey O. Hampton brings out the necessity of thorough examination for posterior wall duodenal ulcers and states that he hopes some day we will be able to tell by our observations whether or not this ulcer is likely to bleed or is a severely bleeding type.

[A similar study covering 123 cases of massive gastro-intestinal hemorrhage and leading to similar conclusions appears under the authorship of Zamcheck, Ritvo, and Osborne in J. A. M. A. **148**: 504–507, Feb. 6, 1952.]

Twelve roentgenograms.

A. WILSON BROWN, M.D.
Shreveport (La.) Charity Hospital

Gastric Diverticula in Infancy. Gloria L. Ogur and Albert J. Kolarsick. J. Pediat. **39**: 723–729, December 1951.

Despite the fact that true gastric diverticula are considered to be of congenital origin, there have been very few reports of this lesion occurring in the pediatric age group. For this reason, and because gastric diverticula must be considered in the differential diagnosis of many intra-abdominal conditions, the authors have reported 2 cases. They could find only 6 other examples of gastric diverticula in children in their review of the literature.

The first case was one of a true diverticulum with intussuception into the stomach, causing gangrene, perforation, and peritonitis. Roentgenograms of the abdomen taken before death (at three days of age) revealed dilated small and large bowel loops. This is the first reported case with these complications, either in an adult or child, and is the only case reported in a newborn infant.

The second case, in a child of one and a half months, is an example of an acquired diverticulum secondary to pyloric stenosis which was unrelieved for nine weeks. This was a diverticulum of the pulsion type.

Two photographs; 1 photomicrograph.

HOWARD L. STEINBACH, M.D.
University of California

Gastric Ulcer: Diagnostic Studies in 100 Cases. James A. Hagans and Malcolm C. McCord. Am. J. Digest. Dis. **18**: 335–337, November 1951.

The differentiation of the benign from the malignant gastric ulcer is a difficult clinical problem that requires the aid of a history, roentgenology, gastroscopy, and laboratory examinations. In order to evaluate the usefulness of various studies in making a diagnosis, a group of 100 cases was selected from the files of the Dayton Veterans Administration Hospital. In all of these the diagnosis of ulcer had been established by roentgenologic study, gastroscopic examination, or direct specimen examination at operation or autopsy. A sufficiently good history and enough laboratory data recorded to complete a thorough study were also requirements for inclusion in the group.

Of the 100 cases selected, 86 were considered benign, 14 malignant.

The age of the patient was found to be of little value in making a differentiation between benign and malignant. Most of the patients were in the fifth to the seventh decades. Of the 14 malignant ulcers, 1 was in the age group twenty to twenty-nine years; 3 in the group thirty to thirty-nine years; 3 in the group fifty to fifty-nine years, and 7 in the sixty- to sixty-nine-year group.

Ulcer pain was present in 62 (72 per cent) of the benign ulcer group and 9 (86 per cent) of the malignant group. It was of no differential significance.

The duration of upper gastro-intestinal symptoms was of little value in diagnosis. One of the carcinoma patients gave a history of symptoms for fifteen years.

Weight loss occurred in both groups and to about the same extent.

Eleven (13 per cent) of the patients with benign gastric ulcer had a previous x-ray diagnosis of duodenal ulcer, while in 15 (17 per cent) a gastro-intestinal study had been considered normal. Of the patients with malignant ulcer, 4 (29 per cent) had a previous diagnosis of duodenal ulcer and 3 (22 per cent) gave a history of normal roentgen findings in previous years.

The histamine gastric analysis test showed that achlorhydria did not exclude a benign ulcer, nor did an elevated hydrochloric acid level rule out a malignant ulcer.

The size of the ulcer was accurately recorded on the x-ray film in 41 cases. In 7 (20 per cent) of the benign lesions, the ulcers were more than 3 cm. in diameter. The other 32 ulcers measured less than 3 cm. There was apparently no connection between the size of the ulcer and the presence of malignant change.

The location of the ulcers gave no clue as to their nature. Over half occurred on or near the lesser curvature.

The appearance of the ulcer on x-ray examination was no criterion of its malignancy. Fifty per cent of the benign ulcers were thought to be malignant, and 33 per cent of the malignant ulcers were thought to be benign.

Gastroscopic examination was performed in 37 cases and the ulcer was visualized in 25 (68 per cent). No ulcer was visualized in 8 (28 per cent) of 29 benign cases and in 4 (50 per cent) of 8 malignant cases.

The authors conclude from their study that no single determination or group of determinations proved to be reliable in separating benign from malignant lesions.

Six tables.

JOSEPH T. DANZER, M.D.
Oil City, Penna.

Peptic Ulcer in Children. Progress of Medical Science. Russell H. Morgan. Am. J. M. Sc. **222**: 590–600, November 1951.

Contrary to the general impression, the incidence of gastroduodenal lesions in childhood is rather high, and the possibility of peptic ulcer should always be kept in mind by those treating young patients with acute or persistent abdominal pain. Roentgen studies of the upper gastro-intestinal tract should be made frequently in children with abdominal distress, though in view of the common occurrence of abdominal pain in this age group, one must expect that gastroduodenal ulceration is usually not the cause. Alexander (Radiology **56**: 799, 1951), however, found evidence of peptic ulceration in over 10 per cent of children with abdominal distress referred for roentgen examination.

It is unfortunate that many radiologists are careless in the performance of gastroduodenal examinations in

the lower age groups. This is perhaps not surprising, first, because children are somewhat difficult to examine and, second, because the yield of significant lesions in children is somewhat lower than in adults. Nevertheless, the incidence of duodenal inflammatory disease is sufficiently high that no radiologist can afford to perform substandard examinations in children. The examination must be as meticulous as that performed in an adult.

The technic for the radiologic diagnosis of peptic ulcer in children is described in detail. Examination should include the careful fluoroscopic observation of the stomach and duodenum, with the exposure of a sufficient number of spot films to obtain filled views and mucosal-relief views of every portion of the stomach and duodenum. Spot films of the duodenum are particularly important, since most of the peptic ulcers in children occur here. Without spot films of the filled duodenal bulb, one cannot be certain whether or not this structure is deformed by an inflammatory lesion.

Gastric Ulcer in the Preschool Child. Report of a Case. John J. Goldsberry. New England J. Med. **245**: 844–847, Nov. 29, 1951.

A case of gastric ulcer in a 5-year-old boy with a history of recurrent abdominal pain since the age of three is presented. Films showed an ulcer crater on the lesser curvature in the antrum. The child is described as being keen, hypersensitive, impressionable, and mature for his age, living in a "mental and emotional no-man's land." An uneventful recovery was made following two weeks of bed rest and an antacid bland diet. There was no return of ulcer symptoms in an eight-month follow-up period.

This is only the sixth case of gastric ulcer reported in children one to six years old. The author feels, on the basis of autopsy reports, that there may be approximately 50,000 children in this age group who have subclinical gastric ulcer at the present time. The reported cases of gastric ulcer in infants under one year and in children from seven to fourteen years also indicate that there must be many more cases in the preschool group. The disparity in reported incidence is attributed to the fact that infants below one year are frequently seen by doctors, in the school age group the public school nursing system provides adequate medical care, while the preschool child is left without controlled medical supervision.

The pathogenesis of gastric ulcer is touched upon. It is felt that the primary factors are psychosomatic, with the psychic influence of emotion, anger, and shock playing a causative role.

Three roentgenograms; 1 chart; 1 table.

BERTRAM LEVIN, M.D.
Minneapolis, Minn.

Internal Biliary Fistula Due to Peptic Ulcer. James M. Sullivan and Louis Hamman. Arch. Surg. **63**: 635–640, November 1951.

Internal biliary fistula is a serious but not too uncommon complication of peptic ulcer as well as of cholelithiasis. Usually the diagnosis can be made by visualization of air or barium sulfate in the gallbladder or biliary system.

An internal biliary fistula, once established, generally remains open until the cause has been removed. Not only may the original fistula remain, but additional fistulae between other organs occasionally develop. The formation of fistula usually intensifies the symptoms in gallbladder disease, and in a patient with peptic ulcer in whom a biliary fistula develops, symptoms of gallbladder disease are usually added to the gastric complaint. Occasionally, however, the acute symptoms of a cholecystitis are immediately and dramatically relieved by the development of a fistula.

The diagnosis can be confirmed roentgenologically if air can be demonstrated in the biliary system or if barium sulfate enters it in the course of a gastrointestinal series. An atonic sphincter of Oddi is so rare that it need not be considered as permitting air or barium sulfate to enter the biliary system. Emphysematous cholecystitis is also extremely rare and, when a diagnosis of this disease is made, it is usually pathognomonic of internal biliary fistula.

Two cases are reported. The first case illustrates one of the complications of duodenal ulcer and one of the dangers which might be encountered during gastric resection. Fortunately, the diagnosis was well established by roentgen examination before the operation was undertaken. Had it not been known that this fistula existed, the common duct might well have been damaged during the removal of the ulcer or the fistula might have been transected and not closed. In either event, the outcome would have been disastrous.

In the second case also, had there not been forewarning of the complication before operation, some danger of injury to the common duct would have been present.

Three roentgenograms; 3 drawings.

ALFRED O. MILLER, M.D.
Louisville, Ky.

Simple Gastric Ulcer and Carcinoma. B. F. Swynnerton and S. C. Truelove. Brit. M. J. **2**: 1243–1246, Nov. 24, 1951.

A survey was made of 375 patients treated for gastric carcinoma. In 26 of the patients there was found some evidence that the neoplasm might have originated in a chronic gastric ulcer, 18 in the prepyloric area and the remaining 8 in the body of the stomach. It would, therefore, seem that prepyloric ulcers should be deemed malignant and treated by surgical resection.

The 26 cases are abstracted in table form as to age, sex, history, x-ray findings, operation, and histology.

Three tables.

FRANK T. MORAN, M.D.
Auburn, N. Y.

Cyst Formation in Relation to the Stomach and Œsophagus. F. Cunliffe Shaw. Brit. J. Surg. **39**: 254–257, November 1951.

According to the author's review of the literature, gastric cysts are of two types. The first is the solitary, moderately large cyst containing gastric epithelium, usually found in relation to the mediastinal esophagus and having no connection with the stomach. The second type consists of diffuse cystic formation in the gastric mucosa and submucosa, with cysts of minute size. (Scott and Payne: Bull. Johns Hopkins Hosp. **81**: 448, 1947). Both types occur as a result of a developmental abnormality, although in rare cases the diffuse form is found in association with gastritis.

The author's patient was a 67-year old woman with symptoms dating back four months. She was found to have (*a*) a large unilocular gastric cyst in the wall of the

fundus, (*b*) gastritis, and (*c*) a penetrating peptic ulcer of the lesser curvature, in an area not related to the location of the cyst.

The case is unusual because of the location of the cyst, the coexistence of a stomach ulcer, and the age of the patient. The author believes that a detached portion of stomach existed in the gastric wall from birth, which was a potential cyst. As a result of the secondary inflammation from the peptic ulceration and gastritis, an inflamatory exudate collected in the cyst and increased its size to produce the clinical picture. This probably accounted for the relatively short duration of symptoms.

One roentgenogram; 4 photomicrographs.

DAVID D. ROSENFELD, M.D.
Fontana, Calif.

Roentgenologic Examination of the Small Intestine. C. Allen Good. Texas State J. Med. **47**: 753–756, November 1951.

For small bowel examination at the Mayo Clinic the patient drinks 250 c.c. of a suspension of barium sulfate in tap water while standing before the vertical fluoroscope. The esophagus, stomach, and entire duodenum are observed at this time, as well as any proximal jejunum that fills. The patient is then observed lying on his right side as the stomach empties. Subsequent roentgenographic examinations are made at intervals, usually about thirty minutes, but varying with the rapidity with which the head of the opaque column travels. When the stomach has emptied from one-half to two-thirds of the original volume of solution, another 250 c.c. of the mixture is given to insure an adequate column for observation.

It is the opinion of the author that the most important indication for this type of examination is gastrointestinal bleeding for which no cause can be found in the esophagus, stomach, first portion of the duodenum, or colon. It is of considerable value also in the diagnosis of lesions causing intermittent or incomplete intestinal obstruction, regional enteritis, diverticulosis of small bowel, Meckel's diverticulum, intussusception, intra-abdominal hernia, tumors, and bands and adhesions of the small bowel.

Although the accuracy of the method does not compare favorably with roentgenologic examination of the stomach or colon, the roentgenologist should be able to recognize the existence of an organic lesion and determine its location in about 85 per cent of the cases.

FRANK T. MORAN, M.D.
Auburn, N. Y.

Afferent Loop Studies after Subtotal Gastric Resection. Stanley H. Lorber and Harry Shay. Am. J. M. Sc. **222**: 544–553, November 1951.

To aid in the diagnosis of intestinal complications after subtotal gastric resection, a double lumen tube with an inflatable balloon on the end was devised to obtain better filling of the afferent loop of duodenum and of the stomach area. This tube was passed by mouth into the stomach and through the gastric stoma. If the tip of the tube passed into the efferent loop, the balloon was inflated to occlude this loop, and barium was given by mouth, which allowed filling of the afferent loop. However, if the tip of the tube passed into the afferent loop, barium was introduced through the tube directly. Fluoroscopy, spot films, and conventional films were used to study the afferent loop thus outlined.

In a control group of patients, without symptoms following subtotal gastric resection, the duodenal stump was "dome-" or "cone-shaped." But there was some variation in the appearance both of the stump and of the mucosal pattern. The results of study in four patients presenting symptoms after subtotal gastrectomy indicated or gave corroborative evidence of reactivation of a duodenal ulcer, of duodenitis, of stump leakage, and of a marginal ulcer.

The method is simple and its use is recommended in those subjects in whom disease of the stoma or afferent loop is suspected and cannot be demonstrated by routine methods. The desirability of removing a duodenal ulcer with the resected stomach is emphasized in this study by the demonstration of a variety of pathological conditions that can occur in the stump area.

Sixteen roentgenograms; 1 drawing.

PAUL W. ROMAN, M.D.
Baltimore, Md.

Intestinal Obstruction, Paralytic Ileus, Mesenteric Thrombosis and Kindred Lesions. L. R. Sante. J. Missouri M. A. **48**: 889–895, November 1951.

Sante routinely uses three roentgenographic positions for the differential diagnosis of intestinal obstruction, paralytic ileus, and kindred lesions. (1) An anterior flat film is obtained with the patient prone; (2) a "lateral decubitus view with patient lying on the left side and the beam directed horizontally from behind forward; (3) a transabdominal view with the patient on his back and the beam directed horizontally across the abdomen.

In complete intestinal obstruction, the roentgen signs are gaseous distention of the intestinal loops proximal to the obstruction, with a "herringbone" design and "ladder pattern"; flaccidity of the bowel distal to the obstruction, without fecal content or gas in the distal segment or rectum. Multiple fluid levels in the gas-distended bowel are a common finding, dependent upon distention of bowel from whatever cause. Pain is cramp-like and intermittent and never as severe as in acute abdominal emergencies.

In paralytic ileus there is generalized gaseous distention of the entire bowel, small and large. The rectum is also distended. Muscular tone is lost and the distended loops appear more as structureless sacs pressing upon each other. Fluid levels may be present. Barium enema studies show the colon to be greatly dilated instead of flaccid as in intestinal obstruction. Pain is not severe in uncomplicated cases.

In localized spastic ileus, isolated gas-filled intestinal loops, usually rather small and limited in extent, are seen. The caliber of the bowel never reaches the same size as in obstruction. Pain may be severe, due to the condition producing the localized ileus, such as ureteral stone, appendiceal abscess, etc.

Arterial mesenteric thrombosis usually affects the superior mesenteric artery which supplies all the small bowel and the colon to the splenic flexure. Symptoms are severe, with agonizing pain and collapse. Initially there is intense contraction of the entire bowel, with no roentgen signs. Later, there are relaxation and gas formation. The gas collection may be slight for a considerable time and bizarre patterns are common. As gas formation progresses, the entire small bowel and the large bowel to the region of the splenic flexure are

seen to be dilated. Differentiation from actual obstruction at the splenic flexure may be difficult without resort to a barium enema. Fluid levels are seen but are fewer than in obstruction; they are produced by blood seeping back into the bowel. Bloody stools are common.

Venous mesenteric thrombosis is accompanied by severe pain but no bowel spasm. The bowel becomes boggy with edema and lies limp in the abdomen. Exudate pours into the lumen, the interstitial tissues of the gut, and even into the abdominal cavity. There is no gaseous distention and therefore no fluid levels. The roentgen appearance is one of uniform density throughout, with gas-distended loops conspicuously absent. The clinical course is rapidly progressive, with symptoms similar to those of internal bleeding.

Twenty-two roentgenograms.

BERNARD S. KALAYJIAN, M.D.
Detroit, Mich.

Roentgen Diagnosis of Duodenum Inversum. W. Hirsch and O. Münch. Fortschr. a. d. Geb. d. Röntgenstrahlen **75**: 445–452, October 1951. (In German)

The diagnosis of duodenum inversum is generally made in cases in which the contrast filling of the duodenum points to abnormalities in its course which may be explained by the complicated processes of rotation to which the gastro-intestinal tract is subject during its fetal development. The fetal rotation of the duodenum is largely due to its longitudinal growth around the so-called "pancreas stem" (Vogt). Inversions of the duodenum may be total or partial, in association with complete or incomplete situs inversus of the abdominal organs. Many anomalies which have been described in the medical literature as duodenum inversum cannot, according to the authors, be considered as true examples but are due simply to changes in the position of the duodenum in such conditions as gastroptosis, kyphoscoliosis, and duodenum mobile. Several cases are presented to prove this observation, and a case of partial situs inversus with inversion of the superior portion of the duodenum is offered as a typical example of a genetically true case of duodenum inversum.

Eight roentgenograms; 1 drawing.

ERNST A. SCHMIDT, M.D.
Denver, Colo.

Spontaneous Gastrojejunostomy. Report of a Case William T. Swartz and Leon J. Sholiton. Surgery **30**: 1021–1025, December 1951.

Although fistulae between the stomach and colon and between the stomach and duodenum are relatively common because of the contiguity of these viscera, a fistulous communication between stomach and jejunum is rare. Such a communication is possible only when the posterior wall of the stomach has been bound to the posterior peritoneal area of the lesser sac by a previous inflammatory reaction within the latter. The process then must extend over the anterior border of the body or tail of the pancreas and erode through the transverse mesocolon into the jejunum.

A case is reported of a 55-year-old white man with tabes dorsalis in whom two gastric ulcers were found. The larger penetrated through the posterior gastric wall, extended along the posterior peritoneal layer of the lesser sac, over the tail of the pancreas, and eroded through the transverse mesocolon. It then penetrated into the jejunum near the ligament of Treitz, producing a spontaneous gastrojejunostomy.

The diagnosis of gastrojejunal fistula was not made prior to surgery in this case because of the failure to demonstrate it roentgenographically and gastroscopically. It was felt that the superimposition of the stomach and the colon upon each other and upon the lesion itself obscured roentgen visualization of the fistula. It is doubted that the entrance of the fistula into the jejunum could be seen on gastroscopy because of the length of the tract.

Three roentgenograms.

Roentgen Findings in Ileo-Jejunitis. Richard H. Marshak, A. I. Friedman, B. Wolf, and B. B. Crohn. Gastroenterology **19**: 383–408, November 1951.

Ileojejunitis constitutes that form of chronic enteritis in which a granulomatous process similar histologically to that in terminal ileitis involves other segments of the small intestine. The distribution of the pathologic process may take one of three forms: (1) localized jejunitis; (2) a progressive type with origin in a distal area, proximal extension, and eventual involvement of all of the ileum and most of the jejunum; (3) a diffuse ileojejunitis presenting from the outset involvement of all or most of the small intestine in a continuous or interrupted pattern. This paper is limited to a study of patients in the last category.

The etiology of ileojejunitis is unknown, but it can be stated that its manifestations are not due to sprue, allergy, secretory or primary vitamin or nutritional deficiencies.

The present study includes 49 cases, 14 in females and 35 in males. The basis for inclusion in the report was the clinical picture confirmed by roentgenographic involvement of the ileum and jejunum.

Briefly the symptomatology is that of progressive disease with a gradual onset of fever, loss of weight, abdominal pain, diarrhea, and on occasion incomplete obstruction. At operation no free fluid was present in the abdomen in any of the cases that were explored. A mass of thickened, rigid, hose-like bowel with a blotchy red discoloration was encountered. A striking feature was the marked overgrowth in mesenteric fat on the serosal surfaces tending to encircle the diseased segment of intestine. The mesentery of the involved portion of the small bowel is greatly thickened, soggy, edematous, and always contains enlarged lymph nodes. "Skip" areas of normal bowel are characteristic.

The roentgen findings closely parallel the pathological features. The earliest mucosal changes in the nonstenotic phase are blunting, flattening, and thickening of the valvulae conniventes. The folds become thick, irregular and partially fused. The bowel lumen and contour are irregular. As ulceration proceeds, a more characteristic pattern is produced. Longitudinal streaks of barium recognized as ulcerations appear. As the thick, blunted mucosal folds are further destroyed, cobblestoning may be noted. The lumen of the bowel becomes narrowed due to beginning cicatricial contraction. Finally, one may see the roentgenologic image of a uniform rigid cast-like tube filled with barium and presenting no mucosal pattern. Some flexibility is evident in contour and mucosal pattern during serial examination; later the roentgen appearance is fixed and unvarying, the flexible quality being replaced by rigidity. In the stenotic stage, many of the rigid loops become constricted to a marked degree, and it is to such areas that the term "string sign" is applied. The stenotic segments often resemble rigid pipe stems,

this appearance being due to thickening and contraction of the bowel wall. The stenosis may extend through 1.0 or 2.0 cm. or over longer segments. Because of the severe narrowing, dilatation of the proximal bowel is frequent, being so marked in some cases as to require surgical intervention for obstruction.

Differential diagnosis usually presents no problem. On occasion the roentgen features may be confused with changes in the small bowel in lymphosarcoma and tuberculosis.

Illustrative cases are reported.

Thirteen roentgenograms.

HUGH A. O'NEILL, M.D.
Cleveland, Ohio

Gas Cysts of the Intestine with Pneumoperitoneum. Philip Somerville. Lancet **2**: 1160–1161, Dec. 22, 1951.

Gas cysts of the intestine (pneumatosis cystoides intestinalis) are usually found unexpectedly at operation or at necropsy. The case presented is of interest because of the preoperative finding of pneumoperitoneum on fluoroscopy and subsequent roentgenography. Films showed the presence of gas in considerable quantity under both sides of the diaphragm. The liver was seen to be considerably depressed, and between it and the diaphragm gas-filled coils of bowel were seen. Since it was thought that chronic perforation might be present, it was considered inadvisable to administer a barium meal, and the stomach was therefore not examined. At laparotomy the first four or five feet of the jejunum and the third part of the duodenum were found to be studded with gas cysts ranging from 1/8 to 1/2 inch in diameter.

The association of a pneumoperitoneum with gas cysts has been described in a few previously recorded cases, and it is suggested that in the absence of evidence of perforation of the bowel its presence may be pathognomonic of intestinal gas cysts.

One roentgenogram.

Pneumoperitoneum in the Newborn. McLemore Birdsong and Eugene M. Frame. West Virginia M. J. **47**: 173–177, June 1951.

Pneumoperitoneum in the newborn is usually secondary to a serious intra-abdominal pathological change which requires prompt and often dramatic therapeutic measures. Most of the cases result from one of the following: (1) intestinal obstruction; (2) trauma; (3) meconium stasis; (4) congenital aplasia of a part of the intestinal tract; (5) vascular insufficiency of the intestine; (6) congenital or acquired diverticulum; (7) Meckel's diverticulum; (8) ruptured appendix; (9) mesenteric thrombosis; (10) ruptured ulceration of the gastrointestinal tract. In adults, emphysematous bullae of the lungs, insufflation of air through the fallopian tubes, and pneumatosis cystoides intestinalis have been considered as causes of pneumoperitoneum.

The authors present two cases of spontaneous pneumoperitoneum of the newborn in which none of these known causes was found. In these cases the condition followed a benign course, and the babies recovered.

In the first patient operation was done but no perforation of the bowel was discovered, although a few small particles of meconium were found on a loop of bowel and a fibrinous reaction was noted on the surfaces of two adjacent loops. Recovery was rapid and uneventful. A normal meconium stool was passed within twenty-four hours after the operation, and postoperative distention was minimal.

The second case was treated expectantly with intravenous fluids and antibiotics, nothing being given by mouth. In four days, x-ray re-examination of the abdomen showed complete resolution of the peritoneal air.

In an effort to discover if benign pneumoperitoneum might be more common than is realized, the authors made x-ray examinations of 80 consecutive newborn babies. In none of these was free air found within the peritoneum.

As a result of this experience the question is raised whether the pneumoperitoneum in the absence of intestinal obstruction requires immediate surgery, or might not better be treated expectantly by antibiotics, parenteral fluids, etc.

Four roentgenograms. SIDNEY KING, M.D.
Hancock, Mich.

Important Clinical Dividends from X-Ray Examination of the Colon. Fred J. Hodges and Howard C. MacMillan. J. A. M. A. **147**: 1191–1194, Nov. 24, 1951.

This article consists of a review of radiological examinations of the colon performed at the University of Michigan Hospital between July 1, 1944, and June 30, 1949. During this time 200,000 patient visits were made to the diagnostic division of the roentgenology department; 7.2 per cent or 15,350 of these represented colon examinations and 71.7 per cent of all such examinations yielded negative results.

Radiologically demonstrable abnormalities of the large intestine were found in 4,291 patients. The largest group within this category, 1,663 patients, showed a variety of miscellaneous conditions, such as postoperative alterations of the colon, fistulous tracts, megacolon, developmental anomalies, displacement by some unusual abdominal mass, hernia involving the colon, volvulus, and others. Considered as a group, demonstrable miscellaneous abnormalities involving the colon directly or indirectly were encountered in the ratio of one to every six and one-half patients shown to be normal on radiologic investigation of the colon.

The most common single pathological entity to be encountered was diverticulosis with or without associated inflammatory disease of the bowel wall: 1,477 patients, or one to every 7.2 individuals found to be normal, were shown to have demonstrable diverticula of the colon, the majority being localized in the middle and proximal portions of the sigmoid.

Conclusive evidence of ulcerative colitis, including all forms, was encountered in 238 patients, a proportion of 1 to every 45 patients found to have normal colons.

Primary neoplasm of the large intestine was reported in 575 patients. This represented an average of 115 patients with such lesions per year in a patient population of 3,000 per year.

One hundred and two patients out of a total of 131 seen during one year were carefully evaluated. The average age of this group was 59.7 years and 64 per cent were males. Symptoms were listed as follows: change in bowel habits (48 per cent), observed blood in stool (43 per cent), and abdominal pain (20 per cent). The earliest symptoms occurred on an average of seven and a half months prior to hospital admission. The average time before consulting a physician was three months.

The leading physical signs were as follows: positive sigmoidoscopic findings, 69 per cent; a palpable mass

on rectal examination, 58 per cent; hemoglobin below 80 per cent, 46 per cent; demonstrable hemorrhoids, 34 per cent; externally palpable abdominal mass, 21 per cent; evidence of distant metastasis, 15 per cent.

In 85 per cent of the 102 patients the lesion was detected on the basis of initial fluoroscopic and standard film examination. In 14 per cent of the patients reexamination by various specialized methods was needed to establish the diagnosis. Fifty-eight of the malignant lesions were located in the rectum, 25 in the sigmoid, 1 in the descending colon, 5 in the left half of the transverse colon, 2 in the right half of the transverse colon, 5 in the ascending colon, and 6 in the cecum.

The average tumor was 5 cm. in length. Seventy-five per cent of the lesions were annular and 23 per cent were polypoid. In 74 patients from whom tissue was available, extension to lymph nodes occurred in 60 per cent.

Statistical records from the University Hospital show that of 303 patients with carcinoma of the rectum and 170 with carcinoma of other segments of the colon, followed sufficiently long to determine five-year survival, 24.4 per cent of the former and 28.8 per cent of the latter were alive at the end of five years after the discovery of the lesion.

One illustration. EDWARD B. SINGLETON, M.D.
University of Michigan

Congenital Microcolon. C. F. Storey and R. W. Sharp. Am. J. Dis. Child. **82:** 345–356, September 1951.

The authors review the literature dealing with congenital narrowings of the gastrointestinal tract, and although they are primarily concerned with the rarest anomaly—microcolon—they consider also other lesions which are related symptomatically, therapeutically, and probably etiologically.

The terms atresia, stenosis, and microcolon have been used in a somewhat confusing manner—as though they were interchangeable. By microcolon, the authors mean a miniature colon, complete with all coats and with a lumen, even though it be almost microscopic, extending through the entire length.

The authors present a case of congenital microcolon in a newborn child who was fretful, showed abdominal distention, and failed to pass meconium for twenty-four hours after delivery. A scout film of the abdomen showed distended loops of bowel, and the Wangensteen maneuver revealed a distended loop, erroneously interpreted as colon, approaching the rectal marker. This led to a preoperative diagnosis of rectal atresia. At operation, congenital microcolon was found, as well as volvulus of the mid ileum. A terminal ileostomy was performed, but the child died eight hours after operation.

The authors discuss the incidence of congenital microcolon, and quote Ewing and Cooke (Brit. J. Surg. **25:** 506, 1938), who estimated that it occurs in about one in 500,000 cases. The etiology and diagnosis of the condition are discussed, and it is suggested that if the child could survive an ileostomy and subsequent anastomosis of the terminal ileum to the proximal stump of the rectum, some patients might be salvaged. So far, however, none of the infants treated by enterostomy have survived.

Four roentgenograms; 1 drawing.

SIDNEY KING, M.D.
Hancock, Mich.

Suprahepatic Interposition of the Colon and Volvulus of the Cecum. Johan Torgersen. Am. J. Roentgenol. **66:** 747–751, November 1951.

Suprahepatic interposition of the colon is a clinically rather unimportant condition because of its rare occurrence and because it generally is considered to give no symptoms. It is said to be found in 0.025 per cent of mass roentgen examinations of the chest. It is more frequent in males, in whom its frequency increases with age. It normally shows a different roentgen appearance in the sexes. In men the colon is to the right or above the liver. While this same appearance may be seen in women, in not a few cases the colon is in front of the liver. The condition is frequently encountered in hospitals for psychotics and mental defectives, a group with a high incidence of ileus and probably volvulus.

There is a negative correlation between interposition and volvulus of the cecum as far as age and sex distribution are concerned. The tendency to interposition in older males appears to counteract the tendency to volvulus of the cecum. The relatively broad lower thorax aperture is probably the cause of the frequent interposition in men.

Observations in a particular case demonstrated that interposition may produce disturbances in the dynamics of the stomach and duodenum. Two cases are cited suggesting a genetic relationship between interposition, volvulus of the cecum, and visceral asymmetry.

Four roentgenograms. A. WILSON BROWN, M.D.
Shreveport (La.) Charity Hospital

Oral Cholecystography. Experiences with the Newer Cholecystopaques. Wendell G. Scott and W. A. Simril. J. Missouri M. A. **48:** 866–870, November 1951.

This report is concerned with three radiopaque media used in cholecystography: Priodax, Monophen, and Telepaque.

Priodax (iodoalphionic acid) has been in use as an oral cholecystographic medium for ten years. It contains 51.38 per cent iodine. Side-effects occur infrequently—nausea, mild diarrhea, and rarely vomiting. Some patients complain of dryness of mouth, urticaria, and dysuria. Except in rare instances the results with this medium have been quite satisfactory.

Monophen, a cyclohexane carboxylic acid compound, was introduced in 1944. It contains 52.2 per cent iodine and only one phenol group as compared to iodoalphionic acid. The side-effects are similar and about the same in frequency and severity. The medium is supplied in 0.5 gram capsules and six to eight capsules are the usual dose. The capsules are large and difficult for some patients to swallow. Satisfactory results have been obtained with this medium.

Telepaque, the newest medium, is an ethyl propanoic acid compound, introduced late in 1950. It also has only one phenol group but contains 66.68 per cent iodine, about 15 per cent more than Priodax or Monophen. Experimental work with animals has proved it to be non-toxic in dosages up to 60 times the normal amount needed for cholecystography. It is supplied in white tablets about the size of aspirin tablets, each containing 0.5 gm. of medium. Six tablets is the usual dosage.

This newest cholecystopaque has been used by the authors in 65 cases. In 50 it was given in the normal manner, with 2 diagnoses of "non-visualization" and 7

of "cholelithiasis." Shadows were obtained in several cases in which visualization had not been successful with iodoalphionic acid.

Fifteen cases were examined four to six hours after ingestion of the newest drug to determine the speed of gallbladder visualization. In only one case was density insufficient for accurate diagnosis. A similar test of 15 cases with iodoalphionic acid showed adequate density in 6 cases and inadequate in 9.

The authors believe that the ethyl propanoic acid compound with its greater iodine content is of definite value in the examination of large patients and in those who have shown poor visualization or none at all on previous studies. It is true that the shadow of the gallbladder is considerably more dense in the average patient, but the density is not believed to be such as to obscure small negative stone shadows.

The authors tried using only four tablets of the newest medium and obtained satisfactory studies in a majority of 25 cases. They feel that this dosage is sufficient in patients weighing under 150 pounds. The larger dosage, 6 tablets, is recommended for heavier patients.

Eight roentgenograms.

BERNARD S. KALAYJIAN, M.D.
Detroit, Mich.

On the Possibilities of Hepatic Angiography. Visualization of the Portal System. Experimental Research. S. Abeatici and L. Campi. Acta radiol. **36**: 383–392, November 1951. (In French)

This report, from the University of Turin (Italy), describes a method of visualization of the portal system by means of injection of Joduron (a 70 per cent organic iodine contrast medium) directly into the spleen. The experiments were carried out in dogs, and the injections were made under anesthesia. In some cases, the needle was introduced into the spleen through a 2-cm incision, while in other cases, the needle was introduced directly through the skin. Injection must be made rapidly, the optimum time being four to five seconds. Best visualization either of the major trunks or intrahepatic branches is obtained by making films between two and four seconds after injection is completed. The spleen contracts vigorously, and the opaque medium is immediately propelled into the portal circulation. Except for minor lacerations of the splenic capsule and small subcapsular hemorrhages due to introduction of the needle, no complications were encountered. The injections should not be repeated at close intervals.

Five roentgenograms show excellent visualization of the portal system.

RODERICK L. TONDREAU, M.D.
University of Pennsylvania

Postcholecystectomy Complications Due to Incomplete Removal of Gallbladder and Cystic Duct. Report of a Case of So-Called Reformed Gallbladder. William B. A. J. Bauer. Arch. Surg. **63**: 612–616, November 1951.

A housewife, 44 years of age, had her gallbladder removed in 1943 for multiple stones. Following the operation, she remained well for four years, after which she experienced "gas attacks," general indigestion, and pain in the right upper quadrant for two years. These attacks had recently increased in frequency and severity. In January 1950, cholecystography was attempted and, following administration of six tablets of Priodax, a faint round density in the right upper quadrant was demonstrated. A double dose of Priodax was given several days later, yielding a more intense shadow and a definite response to the fatty meal. These findings were interpreted as conclusive evidence of postcholecystectomy functioning gallbladder tissue.

A laparotomy was performed and a short cystic duct with a dilated proximal end (so-called reformed gallbladder) was found. At the junction of the cystic duct with the choledochus there was slight kinking of the latter. It was further seen that this was due to traction of the "reformed gallbladder," the latter being firmly adherent to the liver. Further dissection revealed a definite artery to the dilated cystic duct. The pathological diagnosis was chronic cholecystitis of an incompletely removed gallbladder.

It would seem that this is a case in which originally Hartmann's pouch was tied off with the cystic duct intact and secondary dilatation of the pouch occurred. The author feels that cholangiography at the operating table appears to offer the best solution toward minimizing postcholecystectomy symptoms.

One roentgenogram; 1 drawing; 2 photographs.

ALFRED O. MILLER, M.D.
Louisville, Ky.

Value of Radiology in Pancreatitis. Raymond Sarasin. Radiol. clin. **20**: 395–404, November 1951. (In French)

In acute pancreatitis, the simple radiographic examination is most often non-revealing. However, the left hemidiaphragm may show limited motion; also, occasionally one sees small pleural effusions, bands of atelectasis, or small infarcts. The left psoas muscle may be blurred, and a spotty aspect, ascribed by Baylin and Weeks (Radiology **42**: 466, 1944) to plaques of steatonecrosis may be observed. The pancreatitis may be secondary to other disease, as manifested by biliary tract disease, pancreatic lithiasis, or perivaterian duodenal diverticulum. Dyskinetic effects may be noted in the gastric antrum and duodenum during barium studies.

In subacute pancreatitis, the pancreas may be enlarged and displace surrounding organs, visualization being enhanced at times by an accompanying intestinal distention.

In chronic pancreatitis one may see the effects of enlargement of the pancreas and, at times, pancreatic calcification. Enlargement of the head of the pancreas may affect the duodenum or gastric antrum. An enlarged body of the pancreas may press against the lesser curvature of the stomach. Enlargement of the tail may produce pressure against the greater curve of the stomach. In chronic pancreatitis it may be impossible to exclude cyst or tumor of the pancreas.

Five roentgenograms.

CHARLES M. NICE, M.D.
University of Minnesota

THE MUSCULOSKELETAL SYSTEM

Nonendocrine Deviations from the Normal Pattern of Osseous Development. Richard Wagner. Am. J. Dis. Child. **82**: 519–528, November 1951.

This paper describes 6 cases of retarded and 7 of precipitated development of ossification centers, without other evidence of endocrine dysfunction.

Many of the well defined syndromes with multiple congenital anomalies involving mesenchymatous struc-

tures are linked with retarded growth and development. Therefore, in the study of children with deviations from the norm of growth and osseous development, congenital malformations should be recognized. The hormones do affect the skeletal maturation, but the end organ can be affected also by the genetic or constitutional pattern of the individual.

In the group with retarded development (6 boys) the height, with one exception, was markedly below the average for the patient's age. Variations noted were retarded osseous differentiation of the carpal bones, pseudo-epiphyses on the proximal end of both metacarpals of the index finger, asymmetric development, and radio-ulnar synostosis.

In the group with precipitated development (5 girls, 2 boys) the height for the age was average. Five of this group had non-rachitic craniotabes. Some showed early dentition and generally advanced epiphyseal development. One showed on both fifth fingers the deformity of the middle phalanx that occurs in the majority of cases of mongolism. There was also asymmetrical development in this group.

If the growth potential of a child is established in the anlage, like other constitutional characters, it is obvious that deviations from normal growth and skeletal anomalies may be encountered in the same person. Both may be the result of an abnormal gene with pleiotropic effects or of a combination of several such genes.

The presence of certain somatic stigmas and of deviations from the normal growth pattern is indicative that in a questionable case of retarded growth and development the problem is not solely an endocrine one.

Among somatic stigmas frequently encountered in children with or without gross disease or deviations from normal development are: fusion of the ribs, shovel-shaped ends of the sternal extremity of the ribs, clubbing of the thumb with shortening of the distal phalanx, micrognathia, hyperextensibility of joints, nodules on the medial aspects of the auricles, Madelung's deformity, polydactylism, fusion of vertebral bodies, cervical ribs, Dupuytren's contracture, and arched palate.

Growth, skeletal maturation, epiphyseal ossification, and dental development are usually attributed to the activity of the thyroid gland. However, the present study favors the assumption that constitutional and genetic factors are also important.

The paper includes reproductions of 14 films showing the major variations, and tables showing the age of each patient along with other pertinent information.

I. EARL HOLMES, M.D.
University of Louisville

Multiple Hereditary Epiphyseal Anomalies and Osteochondrosis Dissecans. S. Ribbing. Acta radiol. **36**: 397–404, November 1951. (In German)

Four cases of osteochondrosis dissecans are presented. The author believes that this condition develops from more or less completely demarcated bone nuclei which in turn originate from separate centers of ossification often found outside of the main epiphyseal center during the period of growth. Four cases are presented in support of this view. The author first published this opinion in 1937 (Studien über hereditäre, multiple Epiphysenstörungen. Acta radiol., Suppl. 34 1937).

Eleven roentgenograms.

RODERICK L. TONDREAU, M.D.
University of Pennsylvania

Two Atypical Cases of Chondrodysplasia. J. W. C. de Groot. J. Pediat. **39**: 715–722, December 1951.

Two cases of atypical chondrodysplasia are presented. The first patient was a chondrodystrophic newborn infant who had partial arachnodactyly of both the hands and feet. A postmortem roentgen examination demonstrated severe chondrodystrophic changes. The femora, humeri, tibiae, and ulnae were short and wide. The epiphyses were broad and the distal ends of the tibiae and fibulae were replaced by irregularly calcified densities. The ischial bones were severely affected. The vertebrae were split. The costal ends also showed involvement.

At autopsy the transverse processes of the spine were found to be very broad. The pelvic inlet was small. In microscopic sections the liver cells were seen to contain fat vacuoles. Examination of the bones showed that enchondral ossification was practically absent. At the epiphyseal line of ossification, the trabeculae were very irregular and contained islets of cartilage extending into the marrow. The periosteal ossification was normal.

The second case was that of a 2-year-old boy in whom roentgen examination revealed the typical signs of chondrodysplasia. The bones of the extremities were short and were broadened at the ends of the shafts. Both the ulnae and radii were curved at the epiphyseal ends of the shafts, especially the ulnae. The outlines were irregular and some cupping was present. The skull appeared to have a short base. The sella turcica was somewhat elongated. The posterior clinoid processes were angulated posteriorly. There were some irregularities of the anterior surfaces of the bodies of the first and second lumbar vertebrae, which had produced a kyphosis. The only abnormal laboratory test was an elevated serum cholesterol. Thus, this patient had some features suggestive of gargoylism, such as the raised serum cholesterol, abnormal lumbar vertebrae, hepatosplenomegaly, late closure of the anterior fontanelle, and enlarged sella turcica. Otherwise the deformities were characteristic of chondrodysplasia.

Two roentgenograms; 3 photographs.

HOWARD L. STEINBACH, M.D.
University of California

Hyperplastic Callus in Osteogenesis Imperfecta. Report of a Case. A. G. Apley. J. Bone & Joint Surg. **33-B**: 591–593, November 1951.

Hyperplastic callus in osteogenesis imperfecta is rare. The author presents a case in a girl of eighteen, who had experienced repeated fractures from the age of nine months. When seen by the author she showed the typical features of osteogenesis imperfecta of the slender fragile bone type. She had also a painful generalized swelling of the right thigh of some five weeks duration. Initially this was considered to represent a possible acute osteomyelitis or osteogenic sarcoma, but a roentgenogram taken six weeks after the onset of symptoms made the diagnosis clear. This and subsequent films showed the development of a large mass of calcification of bizarre, almost butterfly saape about the lower end of the femur. Recovery following application of a back splint occurred in three to four months. Another fracture sustained while the patient was under observation was not accompanied by hyperplastic callus formation.

Eight roentgenograms; 1 photograph.

E. H. PRICE, M.D.
Indiana University

Hypervitaminosis A. Report of an Unusual Case with Marked Craniotabes. Jay M. Arena, Paul Sarazen, Jr., and George J. Baylin. Pediatrics **8**: 788–794, December 1951.

An unusual case of hypervitaminosis A with severe craniotabes in an infant of six and a half months is presented. This is the youngest infant reported with this condition and the first to show craniotabes. The child was normal at birth, with no evidence of craniotabes. Because of a large anterior fontanel, more than average doses of vitamins were prescribed. At four months the dosage of vitamins was increased because the fontanel was not closing. Daily dosage from the fourth month on was approximately 80,000 U.S.P. units of vitamin A and 11,000 U.S.P. units of vitamin D. At six months of age a swelling was noted on the lateral aspect of the right foot, and severe craniotabes was discovered at the same time. The vitamin dosage was again increased. Roentgenograms were taken, and a diagnosis of infantile cortical hyperostosis was made.

On admission to the hospital, examination showed the entire skull to be extremely soft, with a characteristic "ping-pong ball" sensation throughout. In some areas, particularly about the anterior fontanel, so much softening had occurred that the skull felt more like a stiff membrane than bone. It was impossible to outline the anterior fontanel by palpation. There was a bony fusiform swelling at the distal end of the fifth metatarsal of the right foot but no soft-tissue swelling. Particular pain was produced when the left upper extremity was moved. The liver was felt 2 cm. below the right costal margin. Roentgen examination showed the hyperostotic changes in the long bones typical of hypervitaminosis A. Prompt and complete disappearance of the craniotabes and other symptoms followed withdrawal of vitamin A.

Symptoms of hypervitaminosis A are compared with those of hypervitaminosis D and with those of infantile cortical hyperostosis.

Four roentgenograms.

Osteomyelitis in Infants Following Bone Marrow Puncture. R. Garsche. Schweiz. med. Wchnschr. **81**: 1131–1133, Nov. 17, 1951. (In German)

To the author's knowledge, a diagnostic bone marrow puncture seldom leads to osteomyelitis in infants but a therapeutic puncture does so relatively frequently. Infusion of isotonic saline into the bone marrow causes osteomyelitis less frequently than does a blood transfusion.

The puncture canal is probably not itself the source of infection. Most infants receiving bone marrow infusions or transfusions are afflicted with severe generalized disease and frequently have bacteremia. It seems logical, therefore, that the bone marrow is damaged locally by these procedures, rendering it receptive to the prevailing pathogenic organism. Addition of penicillin (which has proved to be non-irritating to bone marrow) to the infusion liquid is recommended as a precautionary measure.

Two cases are reported:

A 5-month-old infant with severe *E. coli* meningitis was successfully treated with penicillin-streptomycin and pronounced cured on the thirty-first day after admission. For the first few days it had received penicillin and 5 per cent glucose in Ringer solution twice into each tibia. On the fiftieth day osteomyelitis of the right tibia became roentgenologically demonstrable. Antibiotic therapy (streptomycin-penicillin) was resumed and radiologically healing was complete by the 104th day.

In the second patient, an infant of one month with erythroblastosis fetalis, a soft-tissue puncture of the heel for the purpose of a blood count produced a small abscess at the puncture site ten days later, which responded well to penicillin powder. After another ten days generalized swelling of the heel occurred, suggesting osteomyelitis. Roentgen findings remained negative, however, for an additional ten-day period, after which time osteomyelitis of the calcaneus was proved. Healing occurred radiologically after three months, following penicillin therapy.

In each case the deceptive latent period between the apparent cure of the initial infection elsewhere in the body and the appearance of osteomyelitic lesions deserves notice.

Seven roentgenograms.

GERHART S. SCHWARZ, M.D.
New York, N. Y.

Osteochondropathy of the Antero-Inferior Iliac Spine with Special Consideration of the Processes of Ossification of the Apophysis of the Lateral Acetabular Rim. (At the Same Time a Contribution to the Knowledge of the Normal Anatomical Conditions of This Part of the Skeleton During the Period of Growth). E. de Cuveland and F. Heuck. Fortschr. a. d. Geb. d. Röntgenstrahlen **75**: 430–445, October 1951. (In German)

The apophyses of the antero-inferior iliac spine and of the lateral acetabular border are generally not sufficiently visualized or considered in the ordinary x-ray examination. They may, however, be demonstrated by special exposures and positioning in a large number of growing children, and changes in their structure and development may be of great value in the diagnosis of obscure symptoms.

The authors made serial observations on 433 healthy school children. An osseous nucleus of the antero-inferior iliac spine was demonstrable exceptionally as early as ten years in both sexes. At the age of thirteen years it was more frequent in appearance and became quite common between the ages of fourteen and seventeen years in males. The apophyses of the lateral acetabular border appeared occasionally at the age of thirteen years but were seen most frequently between the ages of fourteen and sixteen years; they disappeared entirely after the age of seventeen. Of 48 fourteen-year-old boys, 22 showed an apophyseal nucleus of the antero-inferior iliac spine, while 15 showed a nucleus of the lateral acetabular border radiologically. The apophyseal development in girls is parallel to that in boys but ossification occurs earlier. Of 24 thirteen-year-old girls, 9 had a definite apophyseal nucleus of the antero-inferior iliac spine and 7 had a similar nucleus of the lateral border of the acetabulum. The appearance of the osseous nuclei, as well as their synostosis, is not necessarily simultaneous bilaterally; in 6 cases their occurrence was unilateral. The apophyses may assume various normal forms.

Cases of osteochondropathy of the antero-inferior iliac spine are presented, and the clinical aspects as well as the roentgen changes are described in detail. The characteristic x-ray findings consist in a marked widening of the cartilaginous interspace and wavy and indistinct contours. Pain on pressure, tension, rotation or other movements is the significant clinical mani-

festation of osteochondropathy. Peculiar painful configurations of the antero-inferior iliac spine in adults may be due to the same etiology. Similarity of the symptoms and findings in these cases of osteochondropathy to Osgood-Schlatter's disease of the tibial apophyses, to Perthes' disease, and to other known apophyseal disorders appears evident and seems to establish the diagnosis and classification.

Twenty-four roentgenograms; 6 drawings; 1 photograph; 1 graph. ERNST A. SCHMIDT, M.D.
Denver, Colo.

Osteitis Pubis. Henry Mortensen. Australian & New Zealand J. Surg. **21**: 103–109, November 1951.

Osteitis pubis is a rarefying condition of bone arising as a complication of operations on the lower urinary tract. The majority of cases follow retropubic prostatectomy, but the condition may occur after cystectomy, suprapubic prostatectomy, transurethral prostatectomy, or external urethrotomy.

The clinical picture may be mild or severe, symptoms usually appearing fourteen to twenty-eight days postoperatively. Rarely the onset may be delayed for months. The severe cases are more common than the mild.

Pain is the outstanding symptom. It begins in the midline, associated with tenderness on pressure over the symphysial region, and, with extension of the disease to the rami of the pubes, occurs also in the inguinal region on both sides and the upper medial aspects of the thighs. Later the ischia become involved, with pain in the perineum and buttocks. The muscles attached to the affected bones become spastic, and any movement of the pelvis, as well as micturition and defecation, is extremely painful. The symptoms may last for many weeks or months.

The earliest radiological changes are seen about the third week. The pubes adjacent to the symphysial cartilage have a moth-eaten appearance. The cartilage disappears, and the pubic bones become splayed out. As the disease progresses, areas of rarefaction are seen in the pubic rami. Evidence of lifting and fraying of the periosteum is present. With retrogression, recalcification takes place, even though symptoms may still be present. Bony ankylosis results in the symphysial region, while large masses of bone extend into the muscles in the region of the muscular attachments.

Several theories as to the etiology of the condition are mentioned, including infection, hemostasis, and extravasation of urine, but none has been proved.

In the author's experience the disease is self-limiting and no treatment has proved of consistent value.

Nine roentgenograms. FRANK T. MORAN, M.D.
Lancaster, Penna.

Importance of Minor Myelographic Deformities in the Diagnosis of Posterior Protrusion of the Lumbar Intervertebral Disc. G. Frank Boult, Matthew K. Kiernan, and Arthur E. Childe. Am. J. Roentgenol. **66**: 752–763, November 1951.

The accuracy and value of myelography are directly proportional to the care with which it is performed and to the skill with which it is interpreted. The authors review the literature, pointing out that a "negative error," in which posterior disk protrusion is found at operation following a normal myelogram, is much more common than the opposite, namely, a negative exploration following a positive myelogram. An excellent description of the technic used in myelography is included, which should be studied in detail by those doing this procedure.

The article includes ten short histories of cases in which minor deformities were demonstrated roentgenologically. These cases are well illustrated and are representative of the types of minor deformity which the authors deem important. Such minor deformities are more commonly encountered between L-5 and S-1 than above this level. Many of these are difficult or impossible to recognize fluoroscopically, and a series of at least twelve spot roentgenograms should be made. Oblique views should not be omitted.

The authors stress the necessity of noting and considering minor myelographic deformities in order to keep the procedure from falling into disrepute.

Twenty-nine myelograms.
A. WILSON BROWN, M.D.
Shreveport (La.) Charity Hospital

Neoplasms of the Bony Pelvis Producing the Sciatica Syndrome. Elmer C. Paulson. Minnesota Med. **34**: 1069–1074, 1091, November 1951.

While rupture of a lower lumbar intervertebral disk is by far the most common cause of sciatica, it may be due to a variety of other causes, among which are neoplasms of the bony pelvis. Ten such cases form the basis of this report. In all of these disk rupture was suspected.

The sciatic nerve lies in close apposition to the wing of the sacrum and passes beneath the greater sciatic notch. Invasion of bone by neoplasm from the intervertebral foramina along the course of the nerve to the level of the notch may produce pain of sciatic distribution.

In 5 of the author's cases the pain was due to metastases from carcinoma of the breast, prostate, and lung. There was one case each of giant-cell tumor, chordoma, Ewing's tumor, sarcoma, and lymphosarcoma of the bony pelvis.

Careful study of roentgenograms will bring to light these bony lesions.

Six roentgenograms; 1 drawing.
I. R. BERGER, M.D.
VA Hospital, Chamblee, Ga.

Syphilitic Disease of the Long Bones in the Bantu. Samuel Skapinker and deVilliers Minnaar. J. Bone & Joint Surg. **33-B**: 578–583, November 1951

Apart from fractures, syphilis accounts for or complicates 90 per cent of all bone lesions in the South African Bantu. The authors rely on the serology, multiplicity of bone lesions, radiographic appearance of other parts, response to antisyphilitic treatment, and biopsy in establishing the diagnosis in long bones.

Congenital syphilis is characterized by multiple bony lesions, metaphysitis, periostitis, and osteitis. Gummatous osteitis also occurs, and at times makes diagnosis difficult. In the adult, diffuse or localized osteitis and periostitis are the common manifestations. Periostitis may be of three types: simple thickening, irregular thickening ("lace-work" type), or radiating spicules. The latter form is usually associated with underlying gummata, and biopsy is often necessary for a differentiation from osteogenic sarcoma.

Twenty-two roentgenograms.
RICHARD A. SILVER, M.D.
Indiana University

Traumatic Deformity of the Humeral Head Following Luxation of the Shoulder. F. Gauwerky. Fortschr. a. d. Geb. d. Röntgenstrahlen **75:** 607–627, November 1951. (In German)

It has been recognized that dislocation of the shoulder, especially of the recurring type, may cause damage demonstrable roentgenographically. Associated with the dislocation are tearing of the joint capsule, rupture of the glenohumeral ligament, and often separation of the lip of the glenoid. Subsequent x-ray examination may show a defect in the humeral head. This is really an impression fracture at the posterolateral portion of the articular facet, caused by the lower border of the glenoid or the coracoid process. This the author calls the "typical defect." He describes it as a break in the continuity of the smooth articular bone surface which appears roentgenographically as (*a*) an indentation, (*b*) trough, or (*c*) flattening.

Some authors have considered this defect on the basis of a congenital weakness within the bone. It has been found, however, only following luxation, and must therefore be considered the result of the latter rather than the cause. Congenital shoulder luxation is exceedingly rare and is morphologically entirely different.

The "typical defect" is frequently found shortly after an initial dislocation but is particularly common after repeated luxation. Free bone and cartilage fragments (osteochondritis dissecans) do not enter into the mechanism. Theoretically damage to vessels and subsequent vascularization from the soft tissues could cause separation of a free bone fragment, but this is opposed to clinical and x-ray experience.

The author believes that deformity of the humeral head as a result of a traumatic dislocation occurs more frequently than is recognized clinically. At operation damage to the cartilage has been observed where no impression fracture could be identified radiographically. The defective area is frequently not demonstrable in the usual shoulder projections but must be viewed in profile, especially if it is small. The technic described here comprises a series of films made in the usual anteroposterior projection with rotation of the arm. As various degrees of rotation are reached, the deformity appears at the upper outer border of the articular surface. The arm is then raised obliquely, supporting the head, and views are obtained with the patient rotated toward the apparatus. The defect is then brought out at the lower outer border of the articular surface.

It is believed that follow-up examinations after shoulder luxation may explain symptoms which have previously been unrecognized.

Twenty-eight roentgenograms; 37 drawings.

E. W. SPACKMAN, M.D.
Fort Worth, Texas

Fractures of the Radius and Ulna. E. Mervyn Evans. J. Bone & Joint Surg. **33-B:** 548–561, November 1951.

The author advocates conservative treatment of complete fractures of the shaft of the radius and fractures of both the ulna and radius with displacement. He bases his conclusions on a study of 50 consecutive displaced fractures of both bones of the forearm treated in this way. In all his reductions, a study of the bicipital tuberosity as seen in the roentgenograms played a dominant role.

Fractures of the above-mentioned type have hitherto been regarded as so difficult to reduce and hold that many men advise immediate open reduction and internal fixation. In the reduction of complete displaced fractures of the forearm, angulation and shortening have to be overcome, but the most important element in the restoration of full function is correction of the rotational deformity between the two fragments of the radius. Rotation does not occur between the fragments of the ulna, presumably because of the soft tissues attached to them.

The author has devised a method to determine the rotational deformity involved. By establishing the position of the proximal, uncontrollable radial fragment, the remainder of the limb can be aligned. This yields excellent functional results. The method involves detailed study of the shape of the bicipital tuberosity as seen in anteroposterior roentgenograms and comparison with that of the normal side in varying degrees of rotation.

The author describes the distinguishing radiographic features of the tuberosity in full supination, mid rotation, full pronation, and various gradations between these positions. With information derived from such views, the rotational position of the radius can be determined with an accuracy up to within a few degrees. The shape and texture of this tuberosity vary in different patients and at different ages, but in any one patient the tuberosity is identical on the two sides.

A constant "tuberosity view" technic is employed to achieve standardization. An anteroposterior view of the bicipital tuberosity on the injured side is obtained and compared with views of the normal radius taken with the forearm in neutral position, 30 degrees supination, and 60 degrees supination. Comparison of the outline of the tuberosity on the injured side with that of the normal tuberosity in known degrees of rotation gives an accurate idea of the rotation of the proximal fragment of the radius. Forty-nine out of the author's 50 consecutive cases were reduced successfully without open operation.

Full regard for the rotational element of the deformity is essential for success in conservative management of complete displaced fractures of the radius and ulna.

Twenty-seven roentgenograms.

W. H. SOMERS, M.D.
Indiana University

GYNECOLOGY AND OBSTETRICS

Spontaneous Subarachnoid Hemorrhage Occurring in Noneclamptic Pregnancy. John W. Conley and Carl W. Rand. Arch. Neurol. & Psychiat. **66:** 443–463, October 1951.

Since the advent of cerebral angiography, exact visualization of the source of spontaneous subarachnoid hemorrhage is often possible, and its suitable surgical management may be suggested. This problem becomes more urgent and more difficult when such a hemorrhage complicates an otherwise normal pregnancy.

Spontaneous subarachnoid hemorrhage may occur at any age. The clinical picture is strikingly similar in all cases. The bleeding almost invariably results from leakage of a faulty vessel wall, rupture of an aneurysm, or some other vascular anomaly.

Eight cases occurring during pregnancy without eclampsia are reported. A review of the literature revealed 20 other examples in non-eclamptic pregnant women. Of the total of 28 patients, 12 were

primiparas and 10 were multiparas. In 21 patients the source of the hemorrhage was not determined. A ruptured aneurysm was the cause in 6 patients, and in 1 bleeding was secondary to an angioma of the cerebellum. Nineteen infants lived, 5 died, and the fate of 4 was not stated. In 15 mothers delivery was by the normal route, in 7 by cesarean section. Four died undelivered, and in 2 instances the method of delivery was not stated. Twelve mothers died; of the 16 who recovered, 2 had transient psychosis and 2 were temporarily hemiplegic.

In the presence of spontaneous subarachnoid hemorrhage, the patient's condition permitting, the authors believe that cerebral angiography is indicated. The optimum time for this procedure will depend on the total appraisal of the patient. The procedure may sometimes be carried out during the active hemorrhagic phase. Because it offers the only reliable method of demonstrating the source of bleeding, it is believed that angiography should be employed, especially when mild pre-eclampsia may suggest a toxic basis. The appropriate time and mode of treatment of an accessible aneurysm or vascular anomaly will depend upon the judgment of the neurosurgeon. Unless the actual source of hemorrhage is demonstrated, a conservative regimen, with absolute bed rest for several weeks, should be rigidly enforced.

Three roentgenograms; 1 photograph; 1 photomicrograph.

HUGH A. O'NEILL, M.D.
Cleveland, Ohio

THE GENITO-URINARY SYSTEM

Pneumopyelography. J. Sydney Ritter and William H. Shehadi. Urol. & Cutan. Rev. **55**: 649–652, November 1951.

The use of air in retrograde urography is of great value in demonstrating non-opaque calculi as well as soft-tissue masses in the renal pelvis and ureters which otherwise would be obscured by the opaque medium. Three cases are reported where the plain films and opaque urographic studies failed to demonstrate any abnormal findings, while the use of air in retrograde urography showed the presence of calculi. Three advantages of this latter procedure are listed:

1. Air outlines the renal pelvis, calyces, and ureters without overshadowing their contents or distorting their configuration.
2. Visualization of non-opaque calculi is obtained when other methods have failed.
3. Air is non-irritating, easy to administer, and without danger to the patient.

Seven roentgenograms.

A. WILSON BROWN, M.D.
Shreveport (La.) Charity Hospital

A Possibility for the Demonstration of Renal Function in the Roentgenogram. J. Bader. Fortschr. a. d. Geb. d. Röntgenstrahlen **75**: 462–470, October 1951. (In German)

In pyelonephritis, serial roentgenograms, starting one minute after intravenous injection of the opaque medium and continuing at one-minute intervals, may demonstrate early minimal damage of the renal parenchyma. These slight changes are expressed by delay in the excretion of the medium by the diseased kidney. The method promises to be especially valuable in early diagnosis of tuberculosis. Glomerulonephritis forms a contraindication to intravenous pyelography and is therefore not considered.

Twelve roentgenograms.

ERNST A. SCHMIDT, M.D.
Denver, Colo.

New Growths of the Kidney and Ureter. E. W. Riches, I. H. Griffiths, and A. C. Thackray. Brit. J. Urol. **23**: 297–356, December 1951.

In 1949, Griffiths and Thackray (Brit. J. Urol. **21**: 128, 1949. Abst. in Radiology **54**: 917, 1950) reported on 103 cases of carcinoma of the renal parenchyma. In the present paper the authors attempt to analyze a larger number of cases to see if the previous conclusions were justified and to extend the scope of the research to include pelvic and other tumors of the upper urinary tract. The records of 2,314 cases from 67 centers in the British Isles, covering the period January 1935 to December 1950, were studied. The percentage incidence of the various pathological types was:

Adenocarcinoma	1,746 cases	75.0%
Pelvic tumors		
Transitional-cell	172	7.0
Squamous-cell	69	2.5
Simple papilloma	74	3.0
Wilms' tumor	189	8.0
Primary tumor of ureter		
Malignant	17	0.9
Simple	4	
Others	43	2.0

There were almost twice as many males as females in the series, although there was some variation from this in the individual groups. The right and left kidneys were affected with equal frequency. Bilateral tumors were present in 7 cases of adenocarcinoma and in 1 of Wilms' tumor. The classical triad of symptoms—hematuria, pain, and tumor—gave the first clue to the condition in most instances. Each main group contained a number of symptomless cases which were discovered accidentally.

1. Diagnosis: If hematuria is present when the patient is first seen, cystoscopy should be done before the bleeding stops. In only 1 case was bleeding so profuse as to make the diagnosis between renal and vesical hemorrhage impossible. If bleeding has already ceased when the patient is first seen, it is better to perform intravenous pyelography first. If retrograde pyelography is necessary, it can be done at the time of the single cystoscopy.

A *plain x-ray film* will occasionally show calcification in a renal tumor, but this is not always diagnostic. A roentgenogram of the chest should be taken to exclude pulmonary metastases.

Intravenous pyelography should be carried out in every case of suspected tumor. It will probably indicate the side affected and will certainly determine whether the other kidney is functioning. In the 1,746 cases of adenocarcinoma in this series, intravenous pyelography was performed in 934. Sixty-six per cent of these showed secretion on the affected side. In 29 per cent of those with no secretion the renal vein was involved by tumor thrombosis, while in only 20 per cent of those with secretion was the vein involved.

The results obtained by *retrograde pyelography* justify the reliance placed on it in the diagnosis of renal tumors. It should be employed when there is no secretion on intravenous pyelography or when that examination

leaves the diagnosis in doubt. It helps to define the extent of the tumor, and it should differentiate a pelvic from a cortical growth. In general, cortical tumors produce their main effects on the calyces, and pelvic tumors, whether papillary or squamous, on the pelvis. The preoperative distinction between the two is of great importance in determining whether the ureter should be removed.

The main changes produced in the calyces by a cortical tumor are:

(1) Compression. A crescentic deformity is most characteristic but may indicate a tumor or a cyst.

(2) Obliteration.

(3) Displacement.

(4) Elongation. When this affects a single calyx, its production and interpretation are easy to understand. When all the calyces are affected, giving a spider-leg deformity, it may be very difficult to decide on the presence and location of a growth.

(5) Increase in the angle between two calyces.

(6) Secondary dilatation of calyces and pelvis, resulting from extrinsic obstruction of the ureter by growth in the lower pole. A large growth in this situation may displace the ureter medially.

In all the foregoing examples the renal pelvis is still complete even if distorted or compressed; a filling defect in its cavity usually denotes a tumor of pelvic origin.

Aortography has been found to serve a useful purpose in differentiating tumor from cyst, but it does not appear likely that it will displace pyelography as the main means of diagnosis.

Perirenal oxygen injection has been used in conjunction with intravenous and retrograde pyelography and aortography. In some instances the tumor-bearing area of the kidney was not outlined and at operation it was found that the tumor was adherent. Further experience with this method of investigation may show that its greatest value lies in the assessment of inoperability from local fixity.

II. Survival and the Factors Which Influence It: For this series the method of computing survival has been standardized so that the number of patients alive at the particular period of one, three, five, or ten years is compared with all the possible survivors at the time, having regard to the interval since operation. Every opportunity has been taken to determine the influence of all factors in etiology, pathology, and treatment on prognosis.

Adenocarcinoma: Results of Surgery: Nephrectomy was performed in 998 cases, but 162 patients were not followed beyond the date of discharge from the hospital. Thus for one year, of 685 patients who could possibly have lived, only 535 were, in fact, alive, giving the survival for one year as 80 per cent. The survival for three years dropped sharply to 44 per cent, and for five years to 30 per cent. For ten years only 17 per cent remained alive.

Preoperative Radiotherapy and Nephrectomy: Preoperative radiotherapy was given in 12 cases only, too small a number from which to draw any conclusions.

Nephrectomy and Postoperative Radiotherapy: Of the 131 cases in which cure was anticipated, 86 per cent survived one year, 53 per cent survived three years, 49 per cent survived five years and 27 per cent ten years. The sinister effect of venous involvement on the survival rate was found to some extent to be mitigated by postoperative x-ray therapy. This improvement is in all probability due to the wider field of influence of irradiation, reaching growth that escaped excision.

Effect of Radiotherapy on Metastases and Local Recurrences: Eight cases received radiotherapy for local recurrences and 21 for distant metastases. Survival in the cases with local recurrences was very short in spite of treatment.

Pelvic Tumors: Without question the treatment of choice for tumors of the renal pelvis is nephro-ureterectomy through a double incision in the loin and iliac fossa. Irradiation was used chiefly in inoperable cases and for the treatment of metastases and recurrences.

Wilms' Tumor: A complete statistical survey was carried out on 138 of the 189 cases of Wilms' tumor in this series. The authors state their conclusions as follows: "Radiotherapy plays no part as a sole method of treatment of Wilms' tumours of the kidney, but in conjunction with surgery it is invaluable. If any conclusions can be made, or any policy of treatment advised, after the study of this series it must be recommended that (*a*) small renal tumours that can be easily removed and show no local extension should be treated by nephrectomy alone. If there is any evidence, microscopic or macroscopic, of incomplete removal of growth, postoperative irradiation must be given. (*b*) A large tumour that is considered clinically inoperable is best treated in the first place by preoperative deep x-rays. Reduction in size is usually rapid, especially in the more undifferentiated types, and shrinkage of the tumour can be assessed clinically. Nephrectomy should be performed about three weeks from the beginning of treatment and before skin reactions occur. With healing of the wound, post-operative irradiation is given to the tumour bed, both renal veins, and the regional lymph nodes of both sides. (*c*) Localised bony metastases are no contraindication to nephrectomy, but where pulmonary metastases occur the case should be considered inoperable."

III. Pathology: Under this heading those pathological features of carcinomata of the kidney which are of prognostic significance are considered, and the distribution of metastases as recorded in the returns are briefly discussed. The most important prognostic factor is the histologic grading of the tumor. In adenocarcinoma, invasion of the renal vein is more probable if the growth is of high malignancy, and in transitional-cell tumors of the pelvis the survival depends to a large extent on the histologic degree of malignancy.

Forty statistical tables are included as an appendix.

Twenty-three roentgenograms; 6 photographs; 14 photomicrographs; 21 charts and graphs.

X-Ray Diagnosis of Pyelonephritis. A. Frei. Fortschr. a. d. Geb. d. Röntgenstrahlen **75**: 452–461, October 1951. (In German)

Serial radiography demonstrates that the defective filling of the renal pelves and calyces diagnosed by Prévôt and Berning (Fortschr. a. d. Geb. d. Röntgenstrahlen **73**: 482, 1950) as inflammatory swelling of the mucous membrane as a result of pyelonephritis is in general of transitory nature and cannot therefore be due to anatomic changes. This defective filling is considered by the present writers to represent only certain phases in normal excretion by the renal pelvis or a hypertonic (spastic) condition. It is only natural that these filling defects are observed more frequently in pyelonephritis than in normal kidneys. Increased irritability of the inflamed renal and ureteral system

as a result of catheterization and injection of radiopaque media also plays a definite role. It is therefore impossible to base the early diagnosis of pyelonephritis on the presence or absence of radiopaque filling defects in the renal pelves or calyces.

Thirteen pyelograms. ERNST A. SCHMIDT, M.D.
Denver, Colo.

Normal Intravenous Pyelograms in the Presence of Hydronephrosis: False Impressions Derived from the Use of the Intravenous Method in Neurogenic Bladders. Charles Ney. Urol. & Cutan. Rev. **55**: 667–670, November 1951.

While the intravenous pyelogram is an invaluable diagnostic aid, conclusions reached solely upon this basis may be erroneous. Perhaps the most common error is the acceptance of an inadequate intravenous pyelogram as normal. This occurs in cases of predominantly lower tract disease, especially benign prostatic hypertrophy, where the intravenous method is used to rule out upper tract abnormalities. Many times in such cases poor visualization of the kidneys ensues, but the urologist considers the films normal because there are no upper tract symptoms. Occasionally, an intravenous pyelogram is considered abnormal where actually no abnormality is present, but such cases are customarily checked by the retrograde method. The third way in which an error can result is the appearance of satisfactory and normal intravenous pyelograms where an abnormality can be proved by the application of other diagnostic procedures.

Two cases illustrative of this third type of error are reported. The intravenous pyelograms in both instances gave good visualization of the kidney pelvis and calyces and could be considered normal, but actually a hydronephrosis was present in each. Each patient had a neurogenic bladder. The reflux up the ureters during the performance of cystography revealed moderately severe hydronephrosis.

Two pyelograms; 3 cystograms.

A. WILSON BROWN, M.D.
Shreveport (La.) Charity Hospital

Contrast Sedimentation in Hydronephrosis. R. Seyss. Fortschr. a. d. Geb. d. Röntgenstrahlen **75**: 470–473, October 1951. (In German)

In hydronephrosis it may be possible to demonstrate a sedimentation of the radiopaque medium in the renal pelvis and calcyes by means of x-ray exposures in the erect position. The theoretical explanation for this phenomenon probably lies in delay in the emptying of the pelves and calyces.

Four roentgenograms; 1 photograph.

ERNST A. SCHMIDT, M.D.
Denver, Colo.

Traumatic Lesions of the Urinary Bladder and Urethra. (A Study of 50 Cases). Donald R. Gilbert and Austin I. Dodson. West Virginia M. J. **47**: 359–366, November 1951.

Before the present liberal use of antibiotics, rupture of the bladder or urethra had a high mortality rate. Adequate shock treatment has also helped reduce mortality but it is still very important to know the site and extent of the rupture.

From the bladder, extravasation may take place into the peritoneal cavity, anteriorly into the space of Retzius, or posteriorly under the peritoneum. Rupture of the prostatic urethra may result in perivesical extravasation, while injury to the anterior urethra will allow leakage following the planes of Buck's and Colles' fasciae. Purulent extravasation will spread in all directions without regard for fascial barriers.

In any patient with hematuria, extravasation of urine, or other evidence of serious urinary tract injury (signs of peritoneal irritation, shock, etc.), cystography is indicated. A second film should be made after the opaque fluid is withdrawn to avoid overlooking a small rupture hidden by the filled bladder. If the cystogram is negative, urethrography is then indicated.

Suprapubic cystostomy plus repair of the laceration and control of the infection are the main points in treatment. Small extraperitoneal lacerations may be allowed to heal spontaneously, but exploration is essential to make sure that the laceration is small. Laceration of the prostatic or membranous urethra is treated by approximating the ends with the use of a balloon catheter without suturing. Anterior lesions are sutured over a catheter.

The authors report a series of 30 cases of rupture of the bladder and 20 of rupture of the urethra seen during the past twelve years. There have been no deaths associated with rupture of the bladder since 1941, attributed in part to the conscientious effort made to diagnose the presence of urinary extravasation before it is clinically obvious and to institute prompt operative treatment and in part to the use of the newer chemotherapeutic and antibiotic agents. No late complications were observed. One patient with rupture of the urethra died, but death was attributed to other injuries. In 25 per cent of patients with lacerations of the urethra, strictures developed varying in severity. This complication does not seem to be related to the type of operation performed, location of the lesion, duration of injury prior to treatment, or use of antibiotics.

Four roentgenograms; 1 drawing; 2 tables.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

THE BLOOD VESSELS

Present Status of Arteriography of Peripheral Vessels. Frederick B. Wagner, Jr. Angiology **2**: 499–516, December 1951.

The author believes that the simplicity of arteriography has been over emphasized and its danger minimized. He feels that the procedure should be given the same respect and consideration as any major operation. The risk can be greatly reduced, however, by proper selection of cases, careful choice of contrast medium associated with the performance of sensitivity tests, painstaking technic, and preparedness for immediate treatment if the necessity arises.

The author's technic for peripheral arteriography is described. The open or operative method, although requiring more effort, is considered safer than the closed or percutaneous, since it permits accurate puncture and proximal compression under direct vision and allows operative control if bleeding occurs from an artery following removal of the needle. Teamwork of a roentgenologist, anesthetist, and the surgeon is required. Whenever possible, the roentgenologist should himself assist in the taking of the films.

Arteriography permits accurate visualization of the direction and course of the arteries, width of the lumen,

shape of the inner wall, and arterial displacement by tumors. It can demonstrate the level and degree of arterial obstruction, the amount of collateral circulation, the site of arteriovenous fistulae, the sac of simple arterial aneurysms, and the arterial supply of tumors. In the primarily medical forms of peripheral vascular disease, such as arteriosclerosis obliterans and Buerger's disease, the study is usually academic and is especially prone to prove hazardous.

Special technics such as percutaneous translumbar aortic puncture, retrograde arteriography, and arterial catheterization are briefly discussed and evaluated.

Sixteen roentgenograms.

A Sacculated Aneurysm of the Saphenous Vein. Karl Morgan Lippert and Lawrence D. Frederick, Jr. Ann. Surg. **134**: 924–926, November 1951.

A case is reported of an aneurysm of the saphenous vein near its junction with the femoral vein. The patient, a man of 45 years, complained of a lump on the inner aspect of the thigh, which disappeared when he lay down. There was no history of trauma and no other etiologic factor could be determined. The venogram showed accurately the large sacculation, its position, and its relation to neighboring structures.

At surgery the aneurysm was easily resected along with a portion of the saphenous vein with which it was connected. There was no connection with any arterial channel. The walls of the sac showed the structures usually found in a large vein.

One roentgenogram; 2 photographs; 1 photomicrograph. DAVID D. ROSENFELD, M.D.
Fontana, Calif.

TECHNIC

Extraperitoneal Pneumography. A Preliminary Report. Howard L Steinbach, Richards P. Lyon, Earl R. Miller, and Donald R. Smith. California Med. **75**: 202–206, September 1951.

The presence of a gas in the retroperitoneal tissues makes possible a radiologic visualization of retroperitoneal organs and masses. Retroperitoneal pneumography is accomplished by injecting oxygen at low pressure into the tissues lying between the coccyx and rectum. The technic is quite simple and is described in sufficient detail along with anatomical considerations so that reproduction of the procedure should not be difficult. After placing the needle, oxygen is allowed to flow through sterile rubber tubing at a rate of about 100 c.c. per minute under a pressure of 20 cm. of water. Volumes varying from 200 to 1,200 c.c. have been used. The procedure described had been employed in 30 patients without complications at the time of this preliminary report.

Eight roentgenograms; 1 drawing.
RICHARD A. ELMER, M.D.
Atlanta, Ga.

Tomographic Behavior of Organs and Pressures in Air-Filled Body Cavities. F. Kemper. Fortschr. a. d. Geb. d. Röntgenstrahlen **75**: 475–477, October 1951. (In German)

In patients with pneumothorax or with pneumoperitoneum, tomography at different levels was performed while the intrathoracic or the intra-abdominal pressure was measured at the same time. It was demonstrated that during respiratory standstill in deep inspiration the pressures remained constant during exposure time and that the organs examined were sharply defined on the tomographic films, failing to show motion.

Two roentgenograms. ERNST A. SCHMIDT, M.D.
Denver, Colo.

Electronic Amplification of the Roentgenoscopic Image. Present Status of Moon's Scanning Tube Method. Paul C. Hodges and Lester S. Skaggs. Am. J. Roentgenol. **66**: 705–710, November 1951.

This is a discussion of the present status of Moon's scanning tube method (Am. J. Roentgenol. **59**: 886, 1948. Abst. in Radiology **52**: 771, 1949) for the amplification of the roentgenoscopic image. In a recent paper (Science **112**: 389, 1950) Moon has stated (1) that the focal spot of the electrons on the surface of the target must approximate a mathematical point, that is, have as small a diameter as possible; (2) that it is desirable to operate the tube continuously at 100 ma. and 125 kv.

The various problems involved in the manufacture of such a tube, its cooling, and the proper voltage for maintaining operation are discussed. The detector screens used, as well as the advantages of the new type of circular block of calcium fluoride crystal, which will allow for the desired 4 × 4-inch square scanning surface, are considered. Phototubes and viewing screens are discussed in detail.

Results obtained to date show promise for development of amplification and intensification of images. However, much work remains to be done in improving the output of the scanning roentgen-ray tubes, the efficiency of the detector apparatus, the operation of electronic circuits, and the method of presenting the picture on viewing screens. There is a discussion by Dr. Russell H. Morgan of Baltimore on the work which has been done with Dr. J. W. Coltman and the Westinghouse Electric Corporation in such an intensification.

This highly technical paper requires reading in the original. A. WILSON BROWN, M.D.
Shreveport (La.) Charity Hospital

Radiographic Enlargements in Diagnostic Radiology. D. E. Fletcher and K. A. Rowley. Brit. J. Radiol. **24**: 598–604, November 1951.

The radiographic image may be enlarged geometrically by the use of a special fine focus tube or optically by simple enlargement of the original film by photographic or photomicrographic methods.

The use of the small focus tube is limited to the minor degrees of enlargement but is of value in showing detail in the thicker parts of the body.

The optical method, using special fine grain developer and fine grain film, makes possible enlargement up to four to six times. Though the process is time-consuming, it is useful in selected cases of lesions of the extremities, such as early arthritis and bone disease.

Six roentgenograms. SYDNEY J. HAWLEY, M.D.
Seattle, Wash.

Application of the Land Method of Film Processing in Roentgenology. Preliminary Report. Laurence L. Robbins and Edwin H. Land. J. A. M. A. **147**: 1217–1219, Nov. 24, 1951.

The authors describe the application of the Land method of photographic processing to radiology. This

is a one-step, essentially dry process of film developing. A dark room is not needed and the personal labor factor is practically nil. The entire process takes only one minute. The method is presented in detail, with a step-by-step outline of the chemical reactions involved. The advantages as well as the disadvantages of the method are cited.

One roentgenogram; 2 photographs.

EDWARD B. SINGLETON, M.D.
University of Michigan

A Simple Device for the Side-Marking of Radiographs. Ove Mattsson. Acta radiol. **36**: 356–360, November 1951.

Adhesive tape, which is ordinarily employed to secure metallic letters to cassettes, often casts shadows which interfere with interpretation of roentgenograms. The author has devised simple plastic clips with attached metallic letters which do not cast confusing shadows.

Three roentgenograms; 4 photographs; 4 drawings.

RODERICK L. TONDREAU, M.D.
University of Pennsylvania

Method for Determining Relative Dosage of Biological Samples. Gustave Joyet. Nucleonics **9**: 42–49, December 1951.

This article on radioactivity measurements in connection with biological studies is from the Institute of Radiology, University of Zurich, Switzerland. It may well be of interest to those concerned with standard incineration procedures on biological tissues and liquids. The use of Geiger-Müller counters and the difficult problems of self-absorption, etc., are considered.

Nine illustrations; 4 tables.

S. F. THOMAS, M.D.
Palo Alto, Calif.

RADIOTHERAPY

Modern Trends in Radiotherapy. A. G. S. Cooper. M. J. Australia **2**: 588–592, Nov. 3, 1951.

This article opens with some mention of outstanding contributions to radiotherapy such as Desjardins' classification of cells and tissues in order of sensitivity (Arch. Surg. **25**: 926, 1932). This classification lists in descending order of sensitivity the following cell types: lymphocytes; polymorphonuclear and eosinophil leukocytes; epithelial cells; endothelial cells of blood vessels, pleura, and peritoneum; connective-tissue cells; muscle cells; bone cells and nerve cells. Mention is also made of the contribution of Paterson and Parker to radiotherapy, beginning in 1934 with the first of a series of articles (Brit. J. Radiol. **7**: 592, 1934).

The author devotes some discussion to more promising types of megavoltage equipment such as the cyclotron, synchrotron and betatron, and shows several drawings of installations for such equipment. Although these units have a high initial cost, certain types at least may not have excessive maintenance cost and have the advantages of very high output with considerably better depth dosage than is available with present high-voltage x-ray equipment. One advantage of such highly penetrating radiation is a relatively lesser bone absorption and, consequently, a lesser hazard of bone necrosis. Telecobalt therapy is also given brief mention.

In the discussion of recent trends in treatment of cancer of the breast, considerable emphasis is placed upon the work in recent years of Professor R. McWhirter, of Edinburgh (Brit. J. Radiol. **21**: 599, 1948), who advocates, in Stages I and II, a simple mastectomy followed by radiotherapy to the scar and to the axillary and supraclavicular regions. These latter regions are treated in continuity by highly filtered deep x-ray beams, the tumor dose being of the order of 3,750 r in a three-week period. McWhirter is said to have a group of cases of carcinomata of the breast occurring during pregnancy and lactation with 30 per cent five-year survivals. In this group, however, no surgical therapy was used. Of patients treated radically, 40 per cent are found to have some axillary node involvement, so that it is difficult to make accurate comparisons of simple mastectomy with radical mastectomy, since the axillary nodes are not removed for inspection. McWhirter has made a statistical analysis of clinically Stage I carcinoma, in which, at the time of the simple mastectomy, the subpectoral gland was removed whether it appeared to be invaded or not. On the assumption that the axilla can be regarded as free of malignant disease if the subpectoral node has been found pathologically to be free of invasion, he thus has a series of 85 per cent five-year survivals in Stage I cases.

The criteria of Haagensen (Am. J. Roentgenol. **62**: 328, 1949) of the Presbyterian Hospital in New York, are listed with a plea for their observance in the selection of patients for radical breast surgery. It has been postulated that trauma to tissues liberates a growth-promotion factor which initiates the mechanism of repair in normal tissues and at the same time stimulates any neoplastic cells present in the body.

In the treatment of carcinoma of the cervix uteri, several new methods, such as parametrial radium implants and pervaginal x-ray therapy, are being used. It would appear, however, that these procedures have not given significantly better results than the intracavitary radium implantation technics of the Paris and Stockholm methods. In such clinics, surgery is reserved for a small percentage of cases which have not been controlled by radiation.

Carcinoma of the ovary has been treated for some time by panhysterectomy and postoperative deep x-ray therapy, but the suggestion is made that only ovariectomy be done, the uterus being left as a convenient holder for radium sources.

Early primary carcinomas of the lip and tongue are best treated by radiotherapy, but surgery provides the method of choice in eradicating accessible metastatic lymph nodes. The question of prophylactic neck dissection in cases of carcinoma of the lip is discussed with reference to the figures of Hayes Martin (Cancer **4**: 441, 1951), who reported that 6 per cent of the patients would have benefited from early prophylactic dissection. The present author reports a frequency of neck metastases of 5 per cent as compared to 12 per cent in Martin's series, and he considers the indications for prophylactic node dissection very unconvincing. When a similar statistical analysis was applied to patients with cancer of the tongue, it was shown that approximately 20 per cent could benefit by neck dissection.

The possibilities of radioactive isotopes, especially radioactive iodine in diagnosis and in some cases of thyroid neoplasm, are mentioned. Brief mention is made also of radiophosphorus, radioactive sodium, radioactive gold, and radiostrontium.

Three illustrations; 2 tables.

GEORGE REGNIER, M.D.
University of Arkansas

Simplified Method of Calculating Dosage in Superficial X-Ray Therapy. Samuel Monash. Arch. Dermat. & Syph. **64**: 792, December 1951.

The author believes that, by determining the factors which produce an x-ray output of 1, 2, and 3 r per second, calculations of applied dosage are simplified for contact therapy as used by the dermatologist.

Bismuth Putty in X-Ray Shielding. Efficiency of Material and Advances in Technique. J. Walter Wilson and Ralph Luikart, II. Arch. Dermat. & Syph. **64**: 580–584, November 1951.

One of the authors recently recommended a putty composed of 84 per cent bismuth subnitrate and 15 per cent anhydrous wool fat to replace sheet lead for shielding the peripheral normal skin during roentgen irradiation of a dermatologic lesion (Arch. Dermat. & Syph. **62**: 237, 1950). Careful measurements have now been made of the efficiency of this material in stopping radiation, and additional experience has yielded improvements in technic. When used in the recommended manner, the putty has been found to furnish at least as good a shield as 1.0 mm. of sheet lead and much more than 0.5 mm.

The most troublesome feature in the use of the putty is its tendency to become sticky when it is warmed too much by handling or by high atmospheric temperature. The authors recommend that additional bismuth subnitrate powder be added with the approach of summer and that more of the same powder be lightly dusted over the patient's skin and the surface of the putty before it is applied. Other suggestions are made with regard to handling and using the material.

Two illustrations.

Melanoblastoma and Its Therapy, with Experience in "Short-Distance" Roentgen Therapy. H. Hergarten and L. Hergarten. Fortschr. a. d. Geb. d. Röntgenstrahlen **75**: 559–576, November 1951. (In German)

The authors classify as "melanoblastoma" all malignant pigmented tumors and the benign variety, without reference to the histology of the individual lesion. They explain that in their experience many of these tumors have been histologically malignant and clinically benign, and cite as an outstanding example the "prepuberty melanoma" found in infants and young children. Trauma undoubtedly plays a major role in the development and also in the growth and extension of the neoplasms; benign pigmented moles will become malignant through traumatization and irritation, and locally malignant lesions will spread more rapidly under similar conditions. Another factor of importance, with particular reference to the rate of growth, is the endocrine glands, especially the gonads. Metastases may appear many years after removal of the primary lesion. Bleeding and ulceration are considered as strong presumptive evidence of malignant change.

The following classification is offered:

Stage 1: Primary tumor with no clinical or visible metastasis, or a postoperative locally recurrent lesion.
Stage 2: Primary tumor with regional metastases, especially in the lymph nodes.
Stage 3: Involvement of more distant lymph nodes or distant metastases.

Cases without recognizable tumor, referred for x-ray treatment and follow-up observation after previous surgery, should be considered in a separate class.

The authors deplore exploratory excision and nonradical operation as factors favoring spread of the malignant process. The recognized treatments at the present time are: (*a*) radical surgery; (*b*) wide electrodesiccation; (*c*) radiation therapy. From personal experience they prefer "short-distance" radiation therapy.

Ten photographs; 6 tables.

[The authors do not give detailed technic but indicate that the "short-distance" treatment comprises 800 r per sitting at intervals of twenty-four to forty-eight hours, with total dosage of 10,000 to 20,000 r, sometimes repeated after several weeks.—E.W.S.]

E. W. SPACKMAN, M.D.
Fort Worth, Texas

Control of Inoperable Oral Cancer with Massive Roentgen Therapy. George White and William R. Christensen. New England J. Med. **245**: 719–723, Nov. 8, 1951.

In an effort to control the primary lesion in oral cancer, a radical regimen with massive x-ray dosage was instituted by the authors. They compare the effectiveness of their method, in which a minimum tumor dose of 7,000 r was delivered to 63 patients, with a series of 55 cases treated with conventional dosage (less than 7,000 r tumor dose).

All the lesions treated were proved epidermoid carcinoma. No treatment was modified by histologic grading, and no patients were lost to follow-up. When these patients were first seen, every effort was made to improve the poor status of oral hygiene. As a general policy all teeth were extracted prior to radiation therapy to remove a potential cause for radiation necrosis of the mandible as well as to eliminate local infection and to allow for the use of a large intra-oral portal. An interval of five to seven days was allowed for healing of the gums prior to x-ray therapy.

Treatment was generally carried out through four portals, one intra-oral and three external. Every attempt was made to use a large intra-oral port; the average diameter was 4 cm. The intra-oral treatment was given at a rate of 400 r daily and a total of 6,000 r in air was delivered in a period of fifteen days. The three external portals included two lateral ports and one submental circular port directed to the tumor. The three external ports were used in all cases in which the tumor was in or about the midline. Treatment factors were 250 kv., 15 ma., 0.5 mm. Cu plus 1.0 mm. Al filtration, 40 cm. distance. A maximum dose of 3,000 r was delivered to the external fields and no effort was made to include metastatic nodes. In most cases the total tumor dose varied between 9,000 and 12,000 r delivered in about thirty days. Radiation reaction in the mouth required three months for complete regression.

Of the total number of recurrences in both series of cases (54), only 2 appeared at the end of one year. For

this reason the absence of any local lesion at the end of a year is strong presumptive evidence that the local cancer has been controlled. This is obviously of importance in the management of metastases. If the patients who died within one year with no evidence of local disease are considered as of indeterminate status, the recurrence rates for high- and low-dosage groups are 30 and 85 per cent respectively. Of the entire group of 63 patients who received massive treatment, 25 were still alive at the time of the report, with no evidence of the local lesion. Thirteen of these 25 patients had survived more than three years since the primary disease was treated. In contrast, the group receiving conventional dosage showed only 6 patients in whom the primary lesion was controlled.

Regarding complications, in the low-dosage group there were essentially no sequelae. In contrast, the incidence of sequelae in the experimental group was approximately 25 per cent, equally divided between ulceration and necrosis. In the authors' opinion, however, the sequelae of massive radiation therapy do not constitute a significant contraindication to its use in view of the results.

ROBERT H. LEAMING, M.D.
Memorial Center, New York

Influence of Radiology in the Diagnosis and Treatment of Intrinsic Carcinoma of the Larynx. Mackenzie Davidson Memorial Lecture. Stanford Cade. Brit. J. Radiol. **24**: 582–588, November 1951.

The material for this paper comes from a study of 40 laryngectomies, 30 of which were done because of radiation failures; 27 patients treated with radium needles by the fenestration method of Finzi-Harmer; 103 cases receiving teleradium therapy; and 13 treated solely by x-rays.

The lesions are classified into five stages: Stage 0, "carcinoma in situ," found only by biopsy in preexisting keratosis; Stage I, with involvement of only the anterior two-thirds of one cord; Stage II, in which both cords and the anterior commissure are involved; Stage III, with extracordal extension and fixation; Stage IV, with involvement of other parts of the larynx. Subglottic extension has a bad prognosis and should always be classified as Stage III. The precancerous lesions, benign papilloma and keratosis, do not respond to irradiation.

Radiography, particularly tomography, is of assistance in the diagnosis of laryngeal carcinoma. Biopsy in the hands of a skilled laryngologist is not dangerous. It is of particular use in differentiating post-irradiation changes from persistent disease or recurrence.

Early lesions may be successfully treated by laryngofissure. If the lesions are too advanced, the only feasible operation is laryngectomy. Irradiation by teleradium, needles, or x-rays in general offers a successful method of treatment with less deformity and a better functional result than surgery. Chondronecrosis and perichondritis are becoming rare with teleradium and the higher voltages. The causes of failure of radiation are: too advanced a lesion, subglottic extension, and the combination of keratosis with cancer. Early recognition of radiotherapy failures is of vital importance as surgical treatment is then still possible in the majority of cases. Local recurrences following radiotherapy are not suitable for further irradiation.

Six roentgenograms; 1 photograph.

SYDNEY J. HAWLEY, M.D.
Seattle, Wash.

Juvenile Nasopharyngeal Angiofibroma in the Female. W. B. Finerman. Arch. Otolaryng. **54**: 620–623, December 1951.

Juvenile nasopharyngeal angiofibroma is a rather rare tumor. While a few instances of this neoplasm have been reported in females, some writers believe that it bears a relation to the male endocrine glands and question the authenticity of true nasopharyngeal angiofibroma except in males.

The author presents a case in a 13-year-old girl in whom the diagnosis of juvenile nasopharyngeal angiofibroma was confirmed by three independent pathologists. The appearance and location of the tumor and the clinical course also supported the diagnosis. Since the tumor caused little discomfort and since epistaxis had not occurred, immediate surgery was not undertaken. No constitutional defects were discovered on physical examination and sexual development was normal. Androgen therapy was thought to be contraindicated because of the possibility of hormonal and psychic disturbances. X-ray therapy was therefore instituted. A total of 1,650 r in air was given through a 10 × 10-cm. port to each side of the pharynx, constituting a dose to the tumor of 2,400 tissue roentgens. The following factors were used: 250 kv.p., 1 mm. Cu and 1 mm. Al for added filtration, and a half-value layer of 1.95 mm. Cu. Six weeks after initiation of irradiation, a roentgenogram showed that the neoplasm had receded high into the epipharynx. A projection in the left side of the nose had also receded and shrunken The entire mass appeared whiter and firmer, like any post-irradiation tissue. Symptomatically, too, much improvement was evident: nasal respiration was free and pressure symptoms in the pharynx had disappeared. Further therapy may include implantation of radium seeds. Surgical excision will be delayed as long as possible.

Two roentgenograms; 1 photomicrograph.

Nasopharyngeal Lesions in Sarcoidosis. Lars-Gunnar Larsson. Acta radiol. **36**: 361–373, November 1951.

About 50 per cent of cases of generalized sarcoidosis have nasopharyngeal involvement. The fact that these changes occur more frequently than has been realized is of importance in so far as diagnosis is concerned because their presence affords an easy way to obtain material for histologic diagnosis.

The author reports 11 cases of sarcoidosis of the nasopharynx from the Radiumhemmet, Stockholm In 10 of these there was evidence of generalized sarcoidosis.

Seven of the patients complained of discomfort in the form of nasal obstruction of rather long duration. In the majority of cases the lesions consisted of circumscribed reddish-yellow lobulated infiltrations, confined to the midline of the posterior nasopharyngeal wall at the site of the adenoid tissue. In a few cases, the lesions were so large that they resembled malignant tumors.

Roentgenological examination of the nasopharynx was made in 7 cases. In 2 of them only a slight irregularity in the superior part of the nasopharynx was visible on the lateral projection, whereas in the remaining cases the roentgenologic findings were definitely positive. In 3 patients the lateral projection showed an increase in breadth of the posterior soft tissues in the superior part of the nasopharynx with a more or less polypous bulging of the wall at the site of the pharyngeal tonsil.

In 1 case there was an extensive lobulated soft-tissue shadow in the roof of the nasopharynx, and in another the lesion mainly involved the right lateral wall of the nasopharynx, which showed a definite bulge in the axial projection. In none of the cases was there any demonstrable destruction of bone at the base of the skull.

Because of subjective discomfort, roentgen therapy was employed in 4 of the cases. In all of these, rapid subjective improvement was obtained, but the lesions did not regress rapidly. In 2 of the 4 irradiated cases, biopsy showed evidence of sarcoidosis three and sixteen months after therapy, respectively. Lesions of sarcoidosis have a low radiosensitivity, and the author believes that subjective improvement was probably due to reduction of the radiosensitive lymphatic portions of the diseased tissue. Fractionated therapy was employed, through two or four fields on the face, one of which was treated daily. Each field received 1,500 r (skin dose) in doses of 250 to 400 r. Technical factors were as follows: 160–170 kv., target-skin distance 50 or 60 cm., 0.5 mm. Cu filtration.

Two cases were treated with large doses of Calciferol, and rapid subjective improvement was noted.

Four roentgenograms; 2 photomicrographs; 2 drawings.

RODERICK L. TONDREAU, M.D.
University of Pennsylvania

Carcinoma of the Thymus of Granulomatous Type. A Clinical and Pathological Study. Elizabeth Lowenhaupt and Reynold Brown. Cancer **4**: 1193–1209, November 1951.

It has been stated that Hodgkin's disease in the thymus is not like that in other locations. The authors suspect that cases of thymic carcinoma have been included under the designation of Hodgkin's disease. They point out that carcinoma of the thymus of granulomatous type (mixed tumor of the thymus) has been recently clearly segregated from Hodgkin's disease and they report 9 cases to illustrate the characteristics of the former tumor. The distinguishing features include: (1) a large anterior superior mediastinal mass occurring with relatively minor involvement elsewhere; (2) progression of the tumor by direct extension, such as invasion of overlying skin and involvement of supraclavicular area; (3) the age of the patients (young adults).

Complete surgical resection may be effective early in the disease. Roentgen therapy may in some cases produce permanent arrest in the treated areas. Whenever conditions allow, a dose of from 5,000 to 6,000 r in forty to forty-five days should be given.

Eighteen roentgenograms; 14 photomicrographs; 2 tables.

D. S. CHILDS, JR., M.D.
Rochester, Minn.

Local Recurrence Following Surgery for Cancer of the Breast. Eugene W. Demaree. Ann. Surg. **134**: 863–867, November 1951.

Local recurrence after surgery for cancer of the breast is the surgeon's responsibility and indicates that he has failed to eradicate the disease completely. Although it may be due to operative criteria that are not rigid enough, more often it is the result of surgery that is too conservative for a definitely operable case.

Of 1,044 patients with breast cancer seen by the author in private practice from 1932 to 1949, 365 have died. On 255 of these who had undergone operation the present paper is based. Of these, 151 had radical mastectomies at the author's clinic; 20 of these (12 per cent) showed local recurrence. This compares favorably with other published statistics. The recurrence rate for all cases was 34.4 per cent. One-third of these recurrences were found during the first year and one-third during the second and third years. Sixteen per cent were encountered after the fourth year.

The author believes that wider removal of skin and subcutaneous tissue, thorough axillary dissection and block removal of all tissue would reduce the incidence of local recurrence. Adequate treatment of recurrences may reduce morbidity and mortality. Single skin nodules may be widely excised, but the majority of skin and soft-tissue recurrences are not amenable to surgery. X-ray treatment should consist of a "full carcinocidal dose." This is given to individual nodules if these are surrounded by a wide margin of uninvolved skin, or administered through several rectangular fields if involvement is extensive. The axilla is treated with multiple cross-firing fields. The use of testosterone or surgical or radiation castration has been beneficial in a number of cases, particularly in patients below the menopausal age. Results with estrogenic therapy have been disappointing in the author's experience.

Five tables; 1 graph.

DAVID D. ROSENFELD, M.D.
Fontana, Calif.

Carcinoma of the Cervix. Survival in 98 Cases Treated with Five-Day Radium Only. John W. Bell, Joe V. Meigs, and Charles H. Swan. New England J. Med. **245**: 684–688, Nov. 1, 1951.

The authors point out that for over thirty years carcinoma of the uterine cervix has been treated with radium and roentgen rays used separately or in combination. The present article was prompted by an unusual opportunity to study 98 cases of proved primary carcinoma of the cervix treated with five days use of interstitial radium only. The results demonstrate what has been accomplished by the use of one treatment plan over a ten-year period by two surgeons. All stages except Stage 0 were represented. Each patient received a minimum of 6,000 milligram hours. A follow-up of almost 100 per cent, with a five-year evaluation, was obtained.

The standard plan of radium application used in this group of patients consisted of the insertion of platinum needles into the cervical growth. No central applicator was used. Under anesthesia the needles were inserted circumferentially, with a 3-mg. strength needle usually in the center of the growth and needles of 1 and 2 mg. strength on the periphery of the lesion. These were allowed to remain *in situ* for five days (four days in some cases).

Of the 98 patients, 24 received palliative roentgen therapy for widespread disease or focal metastases. All tumors were graded histologically into three types as outlined by Dr. Shields Warren. No significant correlation between histologic grade of tumor and period of survival could be determined.

Eighteen of the patients experienced recurrent or unrelieved pelvic pain. Failure in the relief of pain is a discouraging factor in the use of radium for palliative or curative purposes. It may be remarked that in the extensive pelvic cancers thus far submitted to radical surgery a striking feature of the postoperative period has been the immediate relief of this disabling symptom.

Five-year survival results with combined radium and roentgen therapy for carcinoma of the cervix as estimated from current literature vary from 20 to 53 per cent. The authors' analysis gives an over-all corrected five-year survival rate of 51 per cent in 98 cases, with an average dose of 7,200 mg. hours of interstitial radium for a five-day period. No attempt has been made to estimate tissue dosage at various sites in terms of gamma roentgens. It is pointed out that this is a small series and not to be considered in any way comparable to end-results reported from larger clinics.

It is obvious that the best results of radium treatment are observed in lesions of Stage I and II, those confined to the cervix and immediate adjacent tissues. Treatment failures in more advanced cases suggest that alternate or supplementary methods such as roentgen therapy or radical surgery must be used.

Five tables. ROBERT H. LEAMING, M.D.
Memorial Center, New York

Ovarian Carcinoma. Johannes Thoms. Acta radiol. **36:** 411–416, November 1951.

Sixty-seven patients with ovarian carcinoma were seen at the Radium Center at Odense, Denmark, between 1929 and 1945. These cases were divided into four groups. Group I: Cases amenable to radical surgery. Group II: Cases submitted to radical operation despite adhesions to or involvement of other organs. Group III: Cases submitted to operation but in which the tumor was incompletely removed. Group IV: Inoperable cases.

Fifty-five patients underwent operation. In 12 cases the operation consisted only of an exploratory laparotomy. All patients received postoperative radiation therapy. In the majority of cases the technic was as follows: Two anterior and two posterior pelvic fields (20 × 24 cm. or 10 × 15 cm.) were treated with x-rays generated at 165 kv., 5 ma., with 0.5 mm. of copper filtration and a skin-target distance of 80 cm. According to individual tolerance, the patients received from 120 to 240 r to each of one or two fields daily. The dose delivered to each field during the entire course ranged from 960 to 2,400 r, measured in air.

The five-year survival rate for the whole series was 26.9 per cent and for Group I cases 68.8 per cent. Eleven patients were still alive and symptom-free at the end of five to fourteen years. Among the 56 patients who died, more than half succumbed within the first year; about 80 per cent within three years.

Five tables. RODERICK L. TONDREAU, M.D.
University of Pennsylvania

Endometriosis: Its Management and End Results. Robert A. Hays and U. V. Portmann. Am. J. Roentgenol. **66:** 773–782, November 1951.

This is a review of 142 cases of endometriosis seen at the Cleveland Clinic from 1939 to 1949, including a discussion of the etiology and the incidence of the condition as well as its pathology. Two types are differentiated: the internal, which is called adenomyosis, and the external. The sites of major involvement in the authors' series of cases were the uterus in 19 per cent; ovary alone in 26.1 per cent; the ovary with other involvements, 32.4 per cent; cul-de-sac, uterosacral ligaments and rectovaginal septum, 16.2 per cent; sigmoid, 2.8 per cent; bladder, 0.7 per cent; appendix, 1.4 per cent; abdominal scar, 0.7 per cent; canal of Nuck, 0.7 per cent.

The authors feel that the history is characteristic of the disease, the most common symptom being dysmenorrhea, which is acquired and progressive in nature. Diagnosis is made chiefly by pathological methods, though a number of cases in this series were diagnosed solely on the basis of the history and physical findings.

Treatment depends on the age of the patient, extent of involvement, and severity of symptoms. Since ovarian function is necessary for the continued growth of the ectopic endometrium, ablation of the ovaries, either surgically or by irradiation, results in relief of symptoms and regression of the lesions. Conservative measures with preservation of some ovarian function are desired, however, whenever possible. In the series presented, roentgen therapy produced the best results with the least morbidity and was satisfactory in 97 per cent of 34 patients treated.

It is estimated that 400 r delivered to the ovaries in the course of a week will usually produce permanent amenorrhea, but the administration of 500 to 600 r is preferable, to be certain that the effects are permanent. All of the treatment may be given anteriorly in increments of 250 r on the skin daily or, for large women, a sacral field may be alternated with the anterior field. Most patients have at least one menstrual period following such a course of treatment; therefore, all should be forewarned of this possibility and that the effects of the treatment and relief of symptoms will not be immediate. Menopausal symptoms following irradiation are best treated conservatively.

Hormone treatment, in the experience of the authors, has been disappointing.

Five tables. A. WILSON BROWN, M.D.
Shreveport (La.) Charity Hospital

Radiotherapy in the Treatment of Kidney Tumours. Alexander A. Charteris. Brit. J. Urol. **23:** 361–363, December 1951.

The author analyzed every case of renal tumor referred to the Department of Radiotherapy, Western Infirmary, Glasgow, during the years 1934–48, including those in which treatment was only palliative. The group included 12 children with Wilms' tumor and 46 adults with cancer of the kidney.

Wilms' Tumor: In 4 cases of Wilms' tumor, 2 inoperable and 2 very advanced, radiotherapy alone was employed; none of these patients survived. In 2 other cases, both advanced, irradiation was given preoperatively; one of these children died soon after operation and the other survived for ten months. The remaining 6 patients had roentgen therapy after nephrectomy; 2 children survived, both for over five years.

Renal Carcinoma: Fifteen cases treated by *radiotherapy alone* were either too advanced for surgery to be attempted or were found so on laparotomy; most of these patients died within one year, but 2 survived up to two years and a third lived for thirteen years. None of the patients treated for *recurrence after surgery alone* is now alive. One of the patients in this group was treated by the author for proved carcinoma of the cervix in 1931; there was no evidence of recurrence of this tumor at the time of her death. In 1941 renal carcinoma developed, which was treated by nephrectomy only. A fairly massive local recurrence took place within one year, and this was treated by irradiation, after which the patient survived for eight years, dying of uremia and nephrosis, without evidence of cancer. In another patient in this group a local recurrence de-

veloped in and below the scar one year after nephrectomy for renal carcinoma. Radiotherapy was employed and a residue in the scar excised. This patient died with an orbital metastasis five years after the recurrence, or six years from the original operation. Twenty-two patients were treated by *surgery and irradiation*, and 7 of these were alive at the time of the report, after periods of eleven (2 cases), seven, six, five and a half, and three and a half (2 cases) years. In comparing this group of patients with a group treated in the Urological Department by nephrectomy alone, it would appear that better results may be obtained where radiotherapy is employed in addition to nephrectomy.

The roentgen therapy was given at 200 to 250 kv., with filtration giving a quality corresponding to a half-value layer of 2 mm. copper. Field arrangements varied from case to case, being planned so as to give an adequate "tumor dose" at the site of the lesion and over as wide an area as possible, the skin dose being kept within certain recognized limits. In general, a tumor dose of 4,000 r in four weeks time was aimed at for a radical course; palliative doses varied according to circumstances.

Two tables.

Discussion on Treatment of Bladder Tumours by Irradiation. D. W. Smithers, W. V. Mayneord, D. M. Wallace, R. J. Walton, and J. E. Stapleton. Proc. Roy. Soc. Med. **44**: 942–944, November 1951.

A discussion on the radiation treatment of bladder tumors at the Royal Cancer Hospital, London, was opened by Smithers with some general introductory remarks. He was followed by Mayneord, who discussed some of the physical principles underlying the radiation treatment of cancer [no details given].

The criteria used in the Royal Cancer Hospital to decide the form of treatment for selected patients with carcinoma of the bladder were outlined by Wallace. The decision is made after the most accurate pathological assessment of the tumor and after consultation between the urologist, radiotherapist, and physicist. Tumors are classified in seven stages based on cystoscopic examination, x-ray and bimanual examination under anesthesia, the histology of the tumor, and possibly the histology of the surrounding mucosa and the regional nodes. Where the tumor is of low or average grade it is assumed that the nodes may still be free of disease.

(1) The apparently simple pedunculated, small, single lesion arising from a normal mucosa, with no evidence of infiltration. Such a tumor can be destroyed completely at one session by radiotherapy.

(2) Larger tumors, over 2.0 cm. in diameter, with infiltration, if any, limited to the muscle. These cases are treated with intravesical or extravesical implants. In the early cases radon seeds have been used, but experiments are now progressing with tantalum wire molds as an alternative, in the hope that this may make for greater accuracy and greater flexibility of dose.

(3) The bladder with widespread mucosal changes and multifocal tumors of a superficial type. Diathermy in these cases is palliative. External irradiation is of slight value. Intravesical irradiation by isotopes in a balloon catheter had been tried to treat the mucosa, but in some of the patients the dose was too high and caused fibrosis and contraction of the bladder. Later, a single dose of 4,000 r calculated as gamma roentgens was given in a single application, with better results. The present technic involves three applications at weekly intervals, as in carcinoma of the cervix.

(4) Tumors beginning to infiltrate. A tumor of more than 1.0 cm. thickness is seldom suitable for any form of interstitial irradiation. Tumors in this group approximately 4.0 cm. in diameter, often highly malignant, have been treated by the 2-mev plant with rotating field technic with good results.

(5) Infiltrating tumors of the fundus of the bladder. These are usually of a high grade of malignancy. They are treated by partial cystectomy followed by radiotherapy to the regional nodes on either side.

(6) More advanced tumors of considerable bulk are treated by high-voltage x-rays. Although some regression under radiation treatment occurred in a fairly high percentage of cases, there were often marked skin reaction and proctitis with x-rays in the 200 to 400-kv. range, which became less serious at the higher voltages.

(7) Bladder tumors in which only palliative measures could be taken. Wallace's opinion is that high-voltage therapy has been given undue prominence in these cases. The best results are to obtained by a combination of methods, with transplantation of the ureters followed by irradiation of the tumor if it causes symptoms, as the main form of palliation.

Walton's contribution concerns the treatment of superficial carcinomas in which most of the mucosa is malignant or premalignant. Experiments were carried out using radioactive solutions contained in a bag in the bladder, similar to a Miller-Abbott tube. At first sodium^{24} was used and this was later replaced by bromine^{82}, which has a short half-life (thirty-six hours) but emits a much greater proportion of its energy in the form of gamma rays. It was thus possible to deliver, at a depth of 4.0 or 5.0 mm., a considerably higher dose as compared with the dose at the surface. After 35 cases had been treated with a single-dose method, a fractionating technic was developed in which the patients received three doses at weekly intervals to a total of approximately 4,500 to 5,000 r measured as gamma rays on the surface. The most common complication of this method has been contraction of the bladder.

Stapleton stated that the indications for radon seed implantation are four. First, the lesion should not be more than 5.0 cm. in diameter. Second, the infiltration must not be more than 1.0 cm. thick. Third, the lesion should be, preferably, single. Fourth, the tumor should be of low or average grade malignancy. The radon seeds are inserted through the open bladder and the dose aimed at is usually 7,000 r. Seeds of 0.8 or 0.9 millicurie are preferred. Difficulty in implanting the seeds uniformly has led to the use of radioactive tantalum wire.

HUGH A. O'NEILL, M.D.
Cleveland, Ohio

The Intravesical Radium Bomb: A Therapeutic Failure in Bladder Tumor. John Duff and Richard M. Hyman. Urol. & Cutan. Rev. **55**: 683–688, November 1951.

In general the treatment of cancer of the bladder, whether by surgery, roentgen rays, or radium, has been unsatisfactory. The authors report their results with the method recommended by Friedman and Lewis (Radiology **53**: 342, 1949) with certain modifications of their own. This involves interstitial irradiation with a 25 to 50-mg. radium source in the form of a capsule introduced with the aid of a Foley catheter.

Nine cases are presented, but in none was a favorable result obtained. All the patients experienced intense burning and excruciating perineal and suprapubic pain after irradiation. Five of the patients are known to have died. A sixth was not followed. Three are living and under observation at the present time. Those who died survived from three to fourteen months; in each there was evidence of extensive recurrent cancer and metastasis.

The authors' experience with this type of treatment leaves them "less than enthusiastic." They state, however, that it may be that some of their cases were so advanced that a fatality was inevitable, and that it should not be concluded from their experiences that radiation will never play an important role in the treatment of bladder cancer.

A. WILSON BROWN, M.D.
Shreveport (La.) Charity Hospital

Study of 68 Patients with Seminoma With and Without Metastasis After Partial X-Ray Castration. W. Renner. Fortschr. a. d. Geb. d. Röntgenstrahlen **75:** 577–583, November 1951. (In German)

The series of 68 cases of seminoma reported here includes both those which were treated prophylactically and those with proved metastasis. All cases were confirmed histologically.

Roentgen therapy was given at 180 to 190 kv., 4 ma., 40 cm. distance, h.v.l. 0.9 mm. Cu. Four abdominal and pelvic fields were treated anteriorly and posteriorly, each field measuring 10 × 15 cm. One or two fields were treated daily, at one to three-day intervals, receiving between 300 and 500 r.

A second similar series after an interval of three months was given if required. The total dosage for prophylactic purposes over the lymph nodes was considered to be 2,500 r (skin dose). If known metastases were present, the total dosage to the local area and lymph distribution was 5,000 r.

The author compares his manner of treating with that in various clinics in his own and other countries. He reports excellent results. Eighty per cent of patients (especially those below thirty-eight years of age) without recognizable metastases and 30 per cent of those with known metastases survived for a five-year period. Preoperative irradiation of the testicle and areas of known metastasis is recommended as a means of preventing postoperative spread, while the value of postoperative irradiation is believed to be definitely established on the basis of this report and other similar reports from the literature.

Seminomas of the right testicle appear to be more malignant than those of the left. It is believed that this is related to the fact that the right testicle descends later than the left.

Two charts; 1 table.

E. W. SPACKMAN, M.D.
Fort Worth, Texas

Induratio Penis Plastica. A Report of 302 Cases. W. Molineus. Fortschr. a. d. Geb. d. Röntgenstrahlen **75:** 584–607, November 1951. (In German)

The author observed 302 cases of plastic induration of the penis from 1931 to 1949, the youngest patient being twenty years of age and the oldest seventy-two. The highest incidence was in the fifth and sixth decades.

Treatment was with either radium or x-rays. Radium was applied in the form of a moulage, 60 to 90 mg., at intervals of one to three days for periods of two or three hours. Occasionally, in more advanced cases, applications were for four and one-half to five hours. Total dosage was between 800 and 900 r. This treatment was repeated in three to six months as required, up to six to ten series. The average for the group was 4,800 r in six series.

For roentgen therapy, the factors were 60 kv.p., 4 ma., 5 cm. distance, with a thin filter of rubber. Two treatments of 400 r each were given on consecutive days. On the average, about 5 series were given within a year. The average case received a total dosage of about 3,600 r, but in some instances this was carried as high as 4,500 r. In previously treated cases, careful fractionation was used and reactions were watched, with dosage generally being held at a lower level. The testicles were carefully protected by lead during the treatments.

It was found that, generally speaking, the younger the patient the better was the prognosis, but that the final result did not appear to be influenced greatly by the duration of the symptoms. After discarding from the series 37 patients who did not complete treatment and 42 who had been previously irradiated, 223 patients, showed the following end-results: excellent 27, good 104, fair 46, and poor 46. The author feels that with similar dosage the results are identical with x-rays and radium.

Two roentgenograms; 10 tables.

E. W. SPACKMAN, M.D.
Fort Worth, Texas

Neuroblastoma. Review of the Literature and Report of Six-Year Cure by Roentgen Therapy. Stanley M. Beck, Jr., and Philip J. Howard. Am. J. Dis. Child. **82:** 325–334, September 1951.

A review of the literature on neuroblastoma shows increasing evidence of a degree of curability of this malignant disease. Whereas authors in the past have considered neuroblastoma as having a hopeless prognosis, with a short duration of life, averaging only a few months after establishment of diagnosis, the authors of this paper now point out that cures *are* being reported. To this growing list of cures they add a case of their own, in which the patient shows normal development and exhibits good health six years after the diagnosis of adrenal neuroblastoma was established by microscopic study of biopsy material.

At the age of nine weeks the patient received a course of roentgen therapy (twenty treatments in thirty-eight days) which delivered an estimated dose of 1,400 r to the tumor site. Two months later, he was given a further course of sixteen treatments in twenty days, delivering an estimated depth dose of 1,250 r. The skin remained in good condition, and the abdominal mass shrunk markedly. At the end of three years, a small indistinct abdominal mass was observed below the xiphoid. Retrograde pyelography showed the left kidney to be lower than the right, but no evidence of a tumor was seen. A third course of roentgen therapy, consisting of thirteen treatments in sixteen days, was given, delivering an estimated tumor dose of 1,400 r. The patient was last seen six years after the diagnosis of neuroblastoma was made. He showed normal development, with no palpable mass and no enlargement of the liver.

The authors review the history and pathology of neuroblastoma, discuss diagnosis and therapy, and suggest that the heretofore hopeless prognosis of this condition should be altered because approximately 10 per cent of all cases reported have resulted in "cures."

Four photographs; 1 photomicrograph.

SIDNEY KING, M.D.
Hancock, Mich.

Roentgen Therapy in Chronic Leukemia. Carsten Müller and Erik Poppe. Acta radiol. **36:** 417–431, November 1951.

While there is general agreement that roentgen therapy has a good palliative effect in chronic leukemia, it is doubtful that life is prolonged by this means.

The authors analyzed 204 cases of chronic leukemia (109 cases of lymphatic leukemia and 95 of myelogenous leukemia) seen at the University Hospital, Oslo, Norway, between 1914 and 1949. An analysis of the results of local, total, and combined therapy demonstrated no statistically significant differences between these methods.

The following rules are observed:

1. Roentgen therapy is given only when subjective discomfort is present, regardless of the blood count. The authors feel that the percentage of hemoglobin and the number of red cells are more important than the leukocyte count.

2. The method of radiotherapy is determined individually. Total irradiation is particularly suitable in chronic myelogenous leukemia with general symptoms, anemia, and severe leukocytosis. In the presence of marked splenomegaly, local treatment is indicated. Local irradiation is employed for lymphatic leukemia.

3. As to dosage, the principle is to achieve capacity for work or relative well-being with the lowest possible irradiation dosage. In total irradiation, the single dose should not exceed 15 r. In local irradiation preferably not more than 100 r and never more than 125 r with a field not exceeding 10 × 25 cm. should be given.

In total irradiation, the authors treat two fields anteriorly and two fields posteriorly, shielding the head and genitals. The technical factors are as follows: 170 kv., 2 ma., 0.5 mm. Cu, target-skin distance 1 meter.

For local irradiation, the technical factors are: 170 kv., 6 ma., 0.5 mm. Cu, target-skin distance 40 cm.

Bone marrow aplasia, as a complication of roentgen irradiation, does not appear to be more frequent after total than after local treatment. In the authors' material 15 patients had signs of bone marrow aplasia, and 10 of them died. Prophylactic measures recommended are: careful observation of the therapeutic reaction and caution in ordering renewed irradiation. Close cooperation between the physician and the roentgenologist is necessary for the adequate control of treatment, especially late in the course of the disease.

Five diagrams; 4 tables.

RODERICK L. TONDREAU, M.D.
University of Pennsylvania

Is It Possible, on the Basis of Morphologic (Histologic) Criteria, to Predict the Response of a Given Case of Hodgkin's Disease to Radiotherapy and to Formulate a Certain Prognosis? R. Gilbert and E. Rutishauser. Radiol. clin. **20:** 382–390, November 1951. (In French)

The histologic classification of Jackson and Parker (Hodgkin's Disease and Allied Diseases. New York Oxford University Press, 1947), who separate Hodgkin's disease into paragranuloma, granuloma, and sarcoma, is the grouping preferred by the authors. In the case of Hodgkin's sarcoma, a relatively poor prognosis can be made on histologic examination of a single node. In the other varieties of Hodgkin's disease it is not possible to formulate a definite prognosis, since biopsies taken from various sites may disclose different histologic pictures.

Five photomicrographs; 1 table.

CHARLES M. NICE, M.D.
University of Minnesota

Roentgen Therapy in Acne. G. Marshall Crawford, Ralph H. Luikart, Jr., and Robert F. Tilley. New England J. Med. **245:** 726–728, Nov. 8, 1951.

The authors report their observations on a group of patients who had received roentgen therapy for acne five to twenty years earlier at the Massachusetts General Hospital.

A total of 58 patients were studied, all of whom had received 500 r (in air) or more. Voltage varied from 75 to 100 kv. The face was treated with two exposures in most instances. Unfiltered radiation was generally used. Weekly treatments were administered and therapy was discontinued when complete clearing had occurred. This treatment was supplemented with proper cleansing measures and a low-fat diet.

The average duration of the acne process was 5.6 years and the average age of the patient at the time of treatment was 21.4 years. The average elapsed time after radiation therapy was 11.3 years.

In evaluating the results the authors found that none of the patients showed any atrophy, pigmentation, depigmentation, or keratosis. All the poor responses had occurred among patients who received less than 800 r. The acne had cleared in 60 per cent of those who had received 800 to 1,000 r, and 75 per cent of the patients who had been given 1,000 r were cured. Regularity of treatment appeared to favor a good response and fewer recurrences.

ROBERT H. LEAMING, M.D.
Memorial Center, New York

Roentgen Therapy in Bursitis of the Shoulder. Analysis of Fifty Cases Using Both Deep and Superficial Techniques. C. M. Witt and P. F. Titterington. J. Missouri M. A. **48:** 870–873, November 1951.

Of the six bursae commonly found around the shoulder, the largest and the one most usually the site of bursitis is the subacromial or subdeltoid. The etiology of bursitis is not known, but it has been held to start as a degenerative process in the tendons underlying the bursal sac, with calcification which may rupture into the bursae or involve its wall. In addition, there is an acute inflammatory process in the bursa and surrounding tissues. Increased tension of the fluid in the sac is said to produce the pain.

The authors insist on radiographic study of the shoulder not only to confirm the clinical diagnosis but for differential diagnosis from fractures, neoplasms, herpes, acute infections, calcinosis universalis, angina, neuralgia, cervical rib, tuberculosis, and apical pulmonary tumor.

The results in 50 consecutive cases treated by irradiation are reported. Thirty-three patients had symptoms of more than a month duration and on that

basis were classified as chronic; 17 were acute. One group of cases was treated with deep therapy, 200 kv.p. with filtration of 1 mm. Cu plus 1 mm. Al; in a second group treatment was superficial at 100 kv.p. with 1 to 3 mm. Al. Portal size was adequate to cover the lesion and varied from 100 to 225 sq. cm. Three treatments of 75 to 150 r were usually given in the first week, with additional treatments, to a maximum of six, at weekly intervals. Total dosage averaged 389 r. Thirty-seven patients received deep therapy and 13 superficial. If no benefit was received after four or five treatments, other therapeutic measures were recommended.

Of the total group, 68 per cent received prompt and/or pronounced relief of pain and 16 per cent late and/or partial relief; 16 per cent were considered failures. Most of the latter were of the chronic group.

Five roentgenograms; 1 table.

BERNARD S. KALAYJIAN, M.D.
Detroit, Mich.

RADIOISOTOPES

Radioactive Isotopes in the Palliative Management of Carcinomatosis of the Pleura. Edward M. Kent and Campbell Moses. J. Thoracic Surg. **22:** 503–515, November 1951.

Nineteen patients with proved carcinomatosis of the pleura associated with a rapidly forming, intractable pleural effusion were treated by local injection of radioactive isotopes into the pleural space. Three died too soon thereafter to permit evaluation of response. Three showed retardation but not total suppression of fluid formation. In 13 cases, fluid formation was completely suppressed.

Iodine^{131} and gold^{198} were employed. No toxicity or radiation sickness appeared. From 10 to 30 mc. of I^{131} were given. Dosage of Au^{198} varied from 20 to 100 mc.

Studies on 12 patients in this series showed 62 per cent of the radioactive iodine to be retained for forty-eight hours, much of this probably being accumulated in the thyroid gland. In one case only 8 per cent of the administered radioactivity was present in the pleural fluid after five days. Because of this rapid disappearance of the isotope from the pleural space, the beneficial action observed is difficult to explain. It is suggested that beta-ray dosage which is insufficient to cause tissue destruction may effect suppression of fluid production.

Radioactive colloidal gold and iodinated serum albumin also appeared to be valuable therapeutic agents. Both of these substances were retained in the pleural space longer than I^{131}. The optimum dosage has not been determined.

Four roentgenograms; 9 photomicrographs; 2 tables.

DONALD DEF. BAUER, M.D.
St. Paul, Minn.

Responses to Radioactive Iodine Therapy in Hyperthyroidism, with Special Reference to Cardiac Problems. Farahe Maloof and Earle M. Chapman. J. Clin. Endocrinol. **11:** 1296–1322, November 1951.

The authors present their observations in 47 cases of hyperthyroidism with associated heart disease or heart symptoms as a chief clinical manifestation treated by radioactive iodine.

Of the 47 patients selected out of a total group of 330 patients with hyperthyroidism, 12 were classified as thyrocardiac (no evidence of organic heart disease that could be assigned to the usual classification while toxic or when euthyroid); 20 had hypertensive and arteriosclerotic heart disease, 8 coronary disease and angina, 4 rheumatic heart disease. Three were unclassified. In this series the ratio of females to males was 2 to 1. All patients were over forty years of age and all but 8 were fifty or older. Thirty-two patients had diffuse toxic goiter, 5 nodular toxic goiter, and 10 recurrent postoperative disease. Of the 47 patients, 25 had associated congestive failure, and auricular fibrillation was present in 28.

The response to therapy indicated that 38 of the 47 patients became euthyroid or hypothyroid after treatment: 21 patients responded after a single dose, 5 after a second dose, and 2 after three doses. No patient was given more than three doses, and the largest single dose was 15 millicuries. The largest total dose was 40.4 millicuries. The average dosage, based on an average uptake of 70 per cent of a tracer amount of radioiodine, was 160 microcuries of iodine^{131} per estimated gram of tissue.

In 12 of 27 patients with auricular fibrillation, cardiac rhythm reverted to normal in from one to six months after radioiodine therapy, all without the use of quinidine. The authors believe that an important guide to the problem of fibrillation is the observation of the serum protein-bound iodine (PBI). A progressive decline of the PBI is observed and the restoration of regular rhythm occurs when the PBI approaches normal.

In all patients with angina, disability was greatly relieved or completely alleviated when the hyperthyroidism was controlled.

The authors discuss the factors which may be responsible for a so-called failure of this method of therapy and indicate that the crudity of the dosage may play a part in the poor response of some patients. They discuss, also, the problem of exacerbation of the thyrotoxic state after radioactive iodine therapy and indicate that in this series there were no such complications. They also state that no benefit is to be derived from pretreatment or additive treatment with antithyroids or iodides.

Nine illustrations; 7 tables.

H. D. KERMAN, M.D.
Oak Ridge Inst. Nuclear Studies

Study and Treatment of 119 Cases of Carcinoma of the Thyroid with Radioactive Iodine. Brown M. Dobyns and Farahe Maloof. J. Clin. Endocrinol. **11:** 1323–1360, November 1951.

This important report summarizes the investigation of 119 patients with carcinoma of the thyroid, who had been studied and treated with radioactive iodine over a period of six years.

Information presented indicates that initial uptake of radioactive iodine by carcinoma of the thyroid, as determined by excretion studies, radioassay of biopsy or surgical specimens, radioautography, and external counting methods was decidedly lower than that of the normal gland. Uptake of the isotope, when present, was usually found in follicular adenocarcinomas and in papillary carcinomas having follicular com-

ponents. In an occasional instance a papillary, anaplastic, or solid cellular carcinoma revealed minute quantities of stored radioiodine. In general, it was felt that, while there was an initial uptake in some of these tumors, it was not sufficient to be of therapeutic value. Although the colloid-forming tumors took up most of the radioactive iodine, there was no correlation between the histologic pattern of the tumor and the uptake of iodine.

Following thyroidectomy, the investigators observed, as have others, that those patients who are most effectively treated with radioactive iodine have tumors which initially take up some of the iodine and then show a prompt increase after total thyroidectomy. In metastases from 11 of 13 follicular and from 4 of 5 mixed follicular and papillary carcinomas, the increased avidity of the thyroid tumor tissue following thyroidectomy was pronounced. The authors point out that, in the usual instance, an appreciable increase after total thyroidectomy was apparent in a relatively short period—three to fourteen days. In several instances, however, the uptake of iodine did not become apparent until some time after removal of the gland.

An effort was made to determine the histologic changes that take place in metastases following total thyroidectomy, and it was observed that they have a tendency to show more resemblance to normal thyroid than before thyroidectomy. The authors conclusively demonstrate that, following total thyroidectomy, accumulation of radioactive iodine in metastases may sometimes cause an increase in the rate of growth of the metastatic lesions. Two instances demonstrated by roentgenograms of skeletal metastases illustrate this phenomenon. These patients responded well to radioiodine therapy, and the progression of the lesions was curtailed. It was felt that the functioning metastases which have a tendency toward growth following total thyroidectomy are those which are most effectively treated with radioactive iodine.

Although the authors indicate that surgical removal of normal thyroid gland, which also permits exploration of the neoplastic process, is probably the method of choice of producing a thyroidectomy, normal thyroid function can also be eliminated by large doses of radioactive iodine. They point out that it is easier to destroy a small postoperative remnant of normal thyroid than the entire normal gland with radioiodine, since hyperplastic thyroid tissue in a small remnant of compensatory hyperplasia makes it more vulnerable to the isotope.

As a means of enhancing the function of metastases, Thiouracil was given to 10 patients: 7 with follicular, 2 with pure papillary, and 1 with a Hürthle-cell carcinoma. All of the first group took up some of the radioiodine after total thyroidectomy. In most of these the uptake was further increased following administration of Thiouracil. One of the 2 pure papillary lesions was only moderately affected, and the single instance of a Hürthle-cell carcinoma showed no uptake following eighteen weeks of Thiouracil therapy. It is believed that Thiouracil is of greatest benefit in those cases in which there is some uptake of radioactive iodine after total thyroidectomy. In only one instance was uptake of radioactive iodine initiated by the administration of Thiouracil. The authors indicate that larger amounts of Thiouracil are required to block the storage of radioactive iodine in metastases than are commonly used to block the uptake in normal thyroid. The usual dosage was 200 mg. of Thiouracil every eight hours, but this was occasionally doubled in order to produce a satisfactory effect. It is emphasized that the difference between patients may be due to large variations in the amount of malignant tissue present in the body. An extensive functioning metastatic disease may require extremely large doses of Thiouracil. It is further illustrated that certain metastases in an individual patient may have functioned while others may not.

In cases treated with Thiouracil no evidence of increased rate of growth of the metastases during the course of administration was obtained. It was also observed that, although a given dose of Thiouracil may be effective for a time, the effect may be lost after long-continued administration of that same dose. This is ascribed to possible changes in the sensitivity of the tumor to the drug, or the fact that the growth of the tumor has made the dosage inadequate.

The methods of treatment of functioning metastases with radioactive iodine varied from repeated small doses over a considerable period of time to a massive dose of radioactive iodine after it was found that a large percentage of the dose would be retained. Many variations between these two extremes were used. The authors raise the question as to whether repeated small doses of radioactive iodine may destroy the functioning capacity of the tumor cells and still not be lethal to the tumor. In several patients the evidence seemed to indicate that this might be the case.

Radioactive iodine was beneficial in 10 out of 50 patients who were subjected to total thyroidectomy and who had known metastatic lesions remaining. Of these patients, 6 had follicular adenocarcinoma, 3 had mixed follicular and papillary adenocarcinoma, and 1 had papillary adenocarcinoma. A few patients with incapacitating metastatic disease were rehabilitated and the rate of growth of some of these lesions was curtailed.

Radiation effects on other tissues of the body following therapeutic amounts of radioactive iodine indicated that a definite decline in circulating lymphocytes of the blood was not an uncommon finding; and that total doses of 800 millicuries in divided amounts and 200 millicuries in a single dose were given without grave changes in the circulating cellular elements. Ovarian failure and localized inflammatory reaction in the urinary bladder occurred in patients with functioning carcinomas of the pelvis, apparently owing to the proximity of the lesion containing the isotope. One patient reflected liver damage, manifest by abnormal retention of bromsulphalein.

Seventeen illustrations, including 6 roentgenograms; 6 tables.

H. D. KERMAN, M.D.
Oak Ridge Inst. Nuclear Studies

Results of the Exploration of 85 Cases of Cancer of the Thyroid with Radioactive Iodine. Robert Coliez, Maurice Tubiana, J. Dutreix, and J. Guelfi. J. de radiol. et d'électrol. **32**: 881–895, 1951. (In French)

That uptake of radioactive iodine is related to thyroid activity is indicated by the experience of the last ten years. Eighty-five cases of thyroid cancer were studied in regard to diagnosis, metastases, therapeutic indications, and the evolution of the disease.

Fasting patients were given 200 microcuries to one millicurie of I^{131} by mouth as a test dose, and counts were taken over the thyroid region as a whole and over many smaller areas of the thyroid by a collimated counter. Tumor tissue usually has less affinity for the radioactive iodine than is exhibited by normal thyroid tissue. Radioactivity zones are plotted, and if the pal-

pable mass and isoactivity zones coincide, the tumor is usually benign. Inversely, if there is variation in contour between the palpated mass and the zone of lesser radioactivity, a malignant lesion should be suspected. More differentiated tumor forms absorb relatively more radioactive iodine.

Metastatic lesions vary in ability to concentrate radioactive iodine. In 22 cases with metastases, the metastatic lesion was suspected in 10 from the external counts. Seven of these had eluded discovery by other means.

The relative concentration of radioactive iodine aids in selecting cases for therapy with this substance. Twenty-five of the 85 cases in this series were thus treated. In addition, destruction of normal thyroid tissue by means of surgical ablation or radioactive iodine may make the primary tumor or the metastases capable of greater uptake. Serial studies may reveal this increased uptake, thus indicating the optimum time for isotope therapy. Twenty-two patients, including 10 with metastases, survived five or more years. Seventeen of these had received x-ray or radium therapy and 13 had received radioiodine. Nineteen had received some form of surgery.

Ten figures; 3 tables. CHARLES M. NICE, M.D.
University of Minnesota

Use of Thiouracil in the Treatment of Metastatic Carcinoma of the Thyroid with Radioiodine. J. E. Rall, Wade N. Miller, Charles G. Foster, Wendell C. Peacock, and Rulon W. Rawson. J. Clin. Endocrinol. 11: 1273–1280, November 1951.

This report is a summary of results obtained from total thyroidectomy, the administration of TSH (thyroid-stimulating hormone), and the administration of Thiouracil in an effort to enhance the capacity of thyroid cancers to concentrate radioiodine. The authors compare the results in patients treated by these methods and indicate that Thiouracil in rather large amounts over a prolonged period was the most effective method in producing an increased uptake of radioiodine.

By observing the amount of radioiodine excreted in the urine ninety-six hours following tracer doses given at approximately six-week intervals throughout the course of Thiouracil administration, the investigators found that three patterns of response were observed: (1) complete failure of Thiouracil to influence the uptake of radioiodine; (2) a gradual increase in avidity of the metastatic lesions; (3) abrupt development of an extremely high uptake of radioiodine by the carcinoma. This last pattern was the one most often observed and was particularly frequent in instances of metastasizing struma and carcinoma with follicular components. In all cases in which Thiouracil was administered, a thyroidectomy was performed prior to administration, so that it was difficult to ascertain whether the increased uptake was a late effect of thyroidectomy or a direct effect of the drug. However, increased collection of radioiodine was induced in 21 of 35 patients with metastatic cancers of the thyroid.

The authors suggest three possibilities to explain the marked enhancement of radioiodine avidity by the metastatic tumors in the more dramatic cases: (1) Thiouracil over a prolonged period of time produces a state of iodine depletion, so that any functioning thyroid tissue becomes avid for the collection of iodine. (2) By producing myxedema, Thiouracil stimulates the pituitary to produce increasing amounts of TSH, which in turn increases the avidity of thyroid tissue for iodine. (3) Large doses of Thiouracil augment the patient's own circulating TSH.

It was possible, by the prolonged preparation of these patients with Thiouracil in the amounts of 1.0 to 1.5 gm. per day, to increase the avidity of the metastatic disease so that therapeutic doses of radioiodine could be administered to 16 patients.

Two roentgenograms; 2 charts; 4 tables.
H. D. KERMAN, M.D.
Oak Ridge Inst. Nuclear Studies

Evaluation of the Conversion of Radioactive Inorganic Iodine to Protein-Bound Iodine as a Diagnostic Aid in Thyroid Dysfunction. William N. Harsha. J. Clin. Endocrinol. 11: 1524–1534, December 1951.

The diagnosis of hyperthyroidism in borderline cases is always difficult with the clinical and laboratory facilities which are available to most physicians. Many hypermetabolic diseases mimic hyperthyroidism, but their etiologies are quite independent of thyroid dysfunction. Hypometabolic situations are also common in connection with many diseases, only one of which is hypothyroidism.

The values obtained by the chemical determination of circulating protein-bound iodine in the serum or plasma display a high degree of correlation with the clinical evidence of thyroid disease. There are few situations that alter the concentration of circulating protein-bound iodine other than thyroid secretory dysfunction. This determination, however, is extremely difficult and expensive and involves many technical pitfalls.

Use of radioactive iodine to evaluate thyroid function represents a decided advance, but the validity of urinary excretion data has been questioned. There is also a wide overlapping of values in borderline hyperthyroid, hypothyroid, and euthyroid persons. The accurate and regular collection of radioactive urine is possible only in institutions where special facilities are available.

The measurement of the rate of uptake of radioactive iodine by the thyroid gland promises to be of real diagnostic value. It does require rather rigid standards in equipment and personnel.

The purpose of the present study was to evaluate the conversion ratio of inorganic radioiodine into protein-bound radioiodine as a diagnostic tool in patients with thyroid dysfunction. It was also considered important to correlate the protein-bound radioiodine concentration with other iodine-containing compounds commonly found in serum and to measure the rate of appearance of each of the compounds. In addition, protein-bound iodine and total protein were determined chemically. In this manner, it was hoped to establish that circulating protein-bound iodine actually represents circulating thyroid hormone.

Eighty patients were studied. Each patient was first reviewed by the medical service and given a tentative clinical diagnosis on the basis of history, physical examination, and laboratory studies consisting of basal metabolic rates and serum cholesterol values. The clinical response to appropriate treatment in each instance was subsequently checked. Each patient received a tracer dose of 100 microcuries of I^{131} in the form of potassium iodide. A 3-c.c. sample of heparinized venous blood was drawn at hourly intervals over a period of thirty hours and then at twenty-four-hour intervals for six days. Total urine samples were col-

lected at eight, sixteen, twenty-four, and thirty hours and then at twenty-four-hour intervals for six days after ingestion of the radioactive iodine. Total urine radioactivity was measured and calculated in terms of the percentage of ingested dose. The total plasma radioiodine activity in each sample of plasma was separated into protein-bound thyroxine, diiodotyrosine, and inorganic radioiodine.

The radioactivity of each sample was counted with a Geiger-Müller tube, identical geometry being used for each sample.

The results of the study are presented graphically, and the following conclusions are reached:

(1) The protein-bound iodine of serum, whether determined chemically or assayed as conversion of inorganic radioiodine into protein-bound radioiodine, was found regularly to parallel the diagnosis and clinical course of the thyroid dysfunction.

(2) There is evidence to show that assay of protein-bound radioiodine probably is an assay of thyroxine radioiodine and is therefore a direct measure of circulating thyroid hormone.

(3) No correlation between protein-bound radioiodine levels and total protein values was observed in the group of patients studied.

(4) The basal metabolic rates and the values for serum or plasma cholesterol did not reliably predict the clinical diagnosis in these patients.

Eight charts.

Changes in Blood Iodine Fractions and Radioactivity Under Therapy. William T. Salter, Michel de Visscher, George B. McAdams, and Ira Rosenblum. J. Clin. Endocrinol. **11:** 1512–1523, December 1951.

It has been reported (Skanse: J. Clin. Endocrinol. **8:** 707, 1948. Abst. in Radiology **53:** 309, 1949) that thyroid function can be distorted with I^{131}, both qualitative and quantitative changes having been observed in the blood iodine fractions. This tradition has led to a disregard of the orderliness of thyroid physiology, even under conservative therapy. Nevertheless, the authors believe if preliminary test doses could afford an accurate preview of thyroxine turnover under therapeutic conditions, a more accurate control of therapeutic dosage would be possible. The investigation described was undertaken to demonstrate the orderliness of thyroxine metabolic turnover even under dosage as high as 50 millicuries of radioiodide, I^{131}.

The data concern the function of the thyroid during the first week after a single dose of radioiodide. They do not involve the stage of marked inflammation and autolysis which follows. Within this interval a striking result emerges, namely, that the daily production of radioactive hormone is essentially independent of isotope dosage, but directly dependent upon the status of the patient as measured by the concentration of serum "hormonal" (protein-bound) iodine.

The orderliness of thyroid function under conservative therapy was demonstrated by two means: First, the pick-up of isotope in the gland was measured in relation to circulating iodide and organically bound iodine, in both stable and radioactive forms. These data were amplified by collateral measurements of serum, urine, and exhaled air. Second, the rate of production of radioactive thyroxine was estimated from serial analyses of the blood, for comparison with the functional status of the patient.

Patients with varying degrees of thyroid function, who had not received any medication with iodine-containing drugs for at least three months, were selected. No patient had undergone gallbladder studies or Lipiodol injection or inhalation within a year. To each fasting patient the dose of I^{131} was administered in tap water, without added carrier. At least 250 ml. of water was ingested, and the patient was not allowed food or drink for an hour thereafter.

It was found that if overwhelming doses of I^{131} are avoided, the functional status of the human thyroid gland is not appreciably altered during the first week after conservative therapeutic dosage with the isotope. The thyroid clearance is the same as found for glands not treated with radioactive iodide; and the thyroxine metabolic turnover rate is the same as with test doses. Consequently, test doses of I^{131} afford a reliable preview of the fate of conservative therapeutic doses over a wide range of thyroid activity.

Six charts; 2 tables.

Radioiodine Tracer Studies in Thiocyanate Myxedema. Charles M. Blackburn, F. Raymond Keating, Jr., and Samuel F. Haines. J. Clin. Endocrinol. **11:** 1503–1511, December 1951.

Fifteen patients with myxedema resulting from the administration of potassium thiocyanate for hypertension were studied to obtain information on the behavior of thiocyanate goiter in man. There were 4 men and 11 women in the group, their ages ranging from forty-eight to sixty-four years. In 10 patients thyroid enlargement was present, varying from a barely detectable goiter to massive diffuse enlargement of both lobes. Two additional patients with moderate diffuse enlargement of the thyroid but with no clinical symptoms of myxedema were included in the investigation.

The basal metabolic rates in these patients were not as low as one would expect with comparable degrees of spontaneous myxedema. Levels of plasma cholesterol were usually elevated. Serum protein-bound iodine was within the range characteristic of myxedema.

Radioiodine tracers of 100 microcuries of I^{131} were given orally with 100 micrograms of sodium iodide as a carrier. In all but 4 cases the amount of iodine excreted in the urine in forty-eight hours was greater than normal. The extrarenal disposal rate, which provides an indirect measure of the rate of radioiodine accumulation by the thyroid, was low in all but one instance. *In vivo* measurements over the thyroid gland twenty-four hours after administration of the dose were less than normal in 11 of 13 cases.

The impaired ability of the thyroid to collect radioiodine could not be correlated with the duration of thiocyanate therapy, size of the gland, or duration of myxedematous symptoms. However, a rough correlation did exist between concentration of thiocyanate in the blood and accumulation of radioiodine by the thyroid. As the level of thiocyanate in the blood fell, the initial low uptake of radioiodine was replaced by an avidity for iodine which usually reached a degree seen only in the diffuse hyperplastic thyroid of exophthalmic goiter. This hyperfunctioning phase persisted for many weeks.

Duration of treatment with thiocyanate could not be correlated with the intensity of the clinical myxedema, the size of the thyroid gland, or even the presence or absence of goiter.

In the 2 patients without myxedematous symptoms withdrawal of the potassium thiocyanate was followed

by increased accumulation of labeled iodine by the thyroids and gradual disappearance of the goiters.

Three charts; 1 table.

Studies on the Blood-Brain Barrier with Radioactive Phosphorus. Louis Bakay. Arch. Neurol. & Psychiat. **66:** 419–426, October 1951.

Radioactive isotopes are being used with increasing frequency to localize brain tumors. Either the locally increased permeability of the blood-brain barrier or the active metabolism of the tumor—it is not at present clear which—causes a higher concentration of some isotopes in the tissues of the neoplasm than in the normal brain. Lindberg and the author, working on the theory that the blood-brain barrier played a decisive role, injected P^{32} directly into the cerebrospinal fluid, by-passing the barrier, and found that this isotope would indeed accumulate rapidly in the brain (Acta physiol. scandinav. **17:** 179, 1949).

In the study reported here, radioactive phosphorus was given to one group of rabbits intravenously in the amount of 20 microcuries per kilogram of body weight. The animals were killed from ten minutes to twenty-four hours after the injections and the P^{32} content of various parts of the central nervous system were determined.

The maximum concentration of P^{32} was reached in the brain twelve to twenty-four hours after intravenous injection and thirty to sixty minutes after intracisternal administration. Following the injections into the cistern, the isotope penetrated the cortex and the lining of the ventricles with equal rapidity and accumulated in the brain substance to its entire depth. A table is included showing the P^{32} content of the various parts of the central nervous system. Following intravenous administration, by far the highest deposit of the isotope was found in the pituitary, which showed about sixty times as much activity as the average white matter.

The effect of the blood-brain barrier is twofold: It slows down the absorption by the brain of phosphorus from the blood and supplies the central nervous system with a relatively small amount of it. The striking difference between the central nervous system and the other "non-protected" organs is well illustrated by the behavior of the pituitary gland.

Fourteen radioautographs; 5 photographs.

HUGH A. O'NEILL, M.D.
Cleveland, Ohio

Use of Radioactive Cobalt in Non-Resectable Head and Neck Cancer. Arthur G. James, Roger D. Williams, and Joseph L. Morton. Cancer **4:** 1333–1336, November 1951.

This paper reports work which has been in progress since 1948 at the Ohio State University Medical Center, developing methods for the interstitial use of radioactive cobalt in cancer tissue (see, for example, Radiology **56:** 553, 1951). Radioactive cobalt (Co^{60}) was selected in preference to other isotopes because certain of its physical characteristics are superior to those of radium. An applicator made of flexible nylon tubing is used, which can be implanted in irregular volumes of tissue around or near major blood vessels. The nylon tubing acts as an effective filter for the beta particles. The cobalt placed in the nylon tubing usually is separated with aluminum spacers of various sizes. The applicator is then sterilized by boiling, and the ends of the nylon tubing stretched so that they may be threaded through the eye of a needle. Guide needles are implanted throughout the field to be treated, following which the nylon applicator is threaded through the eye of the needle and pulled into position. The spacing is so arranged that the tumor receives 1,000 r per day. The cobalt is left in place for an average of some seven to ten days depending upon the amount of radiation that is desired. At the end of that time the applicators are withdrawn without the use of anesthesia. During 1950, 40 cases of head and neck cancer were implanted with radioactive cobalt. In each instance previous treatment, either surgical or radiological, had been administered. The authors present 3 typical case reports to illustrate the use of this isotope in the treatment of cancer of the head and neck.

Four roentgenograms; 1 photograph; 1 drawing.

D. S. CHILDS, JR., M.D.
Rochester, Minn.

Carcinoma of the Cervix: Treatment with Radioactive Cobalt^{60}. The Use of Ring Applicators. J. Wakley. South African M. J. **25:** 523–526, July 1951.

The physical properties of radium and cobalt^{60} are compared, and cobalt^{60} is seen to possess certain advantages as an external gamma-ray source. Its most obvious disadvantage is its relatively short half-life.

The design, construction, and loading of a ring applicator for use in cobalt^{60} therapy of carcinoma of the cervix are described. The measurement of dose rate at the center of such rings by comparison with radium is given and a 10 per cent deviation from theory is noted. Results of absorption measurements show half of this error to be due to absorption in the applicator, but a 5 per cent variation is still unaccounted for.

Five figures. RICHARD A. ELMER, M.D.
Atlanta, Ga.

Intravascular Distribution of Na^{24} Injected Intravenously in Man. Louis Bakay, Bertram Selverstone, and William H. Sweet. J. Lab. & Clin. Med. **38:** 893–903, December 1951.

The investigation reported here was undertaken to learn the elapsed time from intravenous injection into the arm of a single dose of 5 to 30 ml. normal saline containing radioactive isotopes until complete mixing with the blood stream had occurred throughout the major vascular channels of the body.

Seven patients, all of whom were suffering from extensive neoplasms, were used for the study. All but 2 of the patients lay quietly or even motionless throughout the period of withdrawal of the samples, which extended from twenty to ninety-five minutes from the time of injection. In 6 of the patients the dosage of Na^{24} varied from 185 to 230 mc. in 6 to 15 ml. of normal saline; the fluid was injected in five to ten seconds. In the seventh patient 143 mc. were injected in 27 ml. over a period of twenty-six seconds. A superficial vein near (usually above) the elbow was used in each case. Prior to the injection of the isotope, ordinary needles were placed in one or more veins, and numerous blood samples—up to 150—were withdrawn. The beginning and the end of the withdrawal of each sample were recorded, and the mean time was used for plotting. The vessels sampled included the carotid and femoral arteries, the femoral veins, superficial veins from the upper limb as far proximal as the antecubital fossa, and similar veins from the lower limb as high as the knee.

In less than a minute after the injection of the solution of $Na^{24}Cl$, the sodium was completely mixed in the major arteries to limbs and head. Gross variations occurred in the time for venous concentrations to equal those in the arterial blood. The superficial veins of the feet and legs lagged markedly behind those of the upper limbs unless the individual was vigorously active. Sluggish circulation accompanied by the flow of unlabeled sodium from the extravascular fluid and/or blood pooled in stagnant veins markedly delayed mixing. This may be associated either with a motionless state, multiple local thromboses, or vasoconstriction.

When rates of transcapillary exchange of electrolytes are to be studied, many early arterial determinations are desirable, since one can be certain of complete mixing before the first minute only in these vessels, and the more rapid of the various rates of exchange are so fast that they may be missed by analyses of later data. The authors suggest that three rather than two rates of exchange of Na^{24} per minute may more nearly describe the processes occurring normally. Such rates in a motionless stuporous man were 55 per cent, 9 per cent, and 2 per cent, and in a powerfully moving person were 150 per cent, 10 per cent, and 0.2 per cent.

Six graphs.

Measurement and Handling of Radioactive Materials for Therapeutic Use. W. K. Sinclair. Nucleonics **9**: 35–42, December 1951.

This article emanates from the Royal Cancer Hospital in London, England, and shows the methods of handling radioactive materials followed there, some of which are in contrast to those in use in America. The criteria for measurements are set up and outlined in detail, and methods for handling solids as well as liquids are discussed.

Ten illustrations.

S. F. THOMAS, M.D.
Palo Alto, Calif.

RADIATION EFFECTS

Radiation Cancer of the Pharynx. A. W. G. Goolden. Brit. M. J. **2**: 1110–1112, Nov. 10, 1951.

The author reviews the literature in reference to radiation-induced cancer in tissues deep to the skin following external irradiation. The majority of such tumors have been sarcomata which have arisen in bone. Hatcher (J. Bone & Joint Surg. **27**: 179, 1945. Abst. in Radiology **46**: 211, 1946) found 24 such cases in the literature, of which 17 were in patients primarily treated for tuberculous arthritis. The interval between irradiation and appearance of the tumor varied from three to twelve years. In most cases the irradiation had been excessive, with repeated doses over long periods of time.

Reports of 6 other cases of cancer developing in deep tissues after external therapeutic irradiation for benign conditions were found by the author. Four of these occurred in the laryngopharynx, one arose in the larynx, and one in the thyroid gland. The benign conditions primarily treated were tuberculous adenitis and thyrotoxicosis. The time interval from the treatment of the primary condition to the development of cancer in this group of cases varied from thirteen to twenty-eight years.

Four additional cases are now reported. Three of the patients were treated for thyrotoxicosis and one for tuberculous adenitis. The tumors occurred in the laryngopharynx after a latent interval of twenty-six to thirty years. In 3 of the patients it was known that frequent repeated x-ray treatments were given over a period of six months or more. In the 3 patients treated for thyrotoxicosis the tumors arose approximately 4 cm. deep to the center of the irradiated skin. Dosage and other treatment factors are not mentioned. The author lists the criteria considered to be of importance in arriving at a diagnosis of radiation-induced cancer.

It seems reasonable to speculate that, if treatment of thyrotoxicosis and tuberculous adenitis by intense or prolonged irradiation was a common practice twenty-five to thirty years ago, other cases of radiation cancer in the laryngopharynx may occur.

ROBERT H. LEAMING, M.D.
Memorial Center, New York

Clinical and Pathological Characteristics of Radiation Cataract. David G. Cogan, David D. Donaldson, and Algernon B. Reese. Arch. Ophth. **47**: 55–70, January 1952.

The authors review the clinical findings in 20 early cases of radiation cataract and discuss the histologic changes in cross sections from 27 cases representing various stages of cataract formation following irradiation.

The material comprising the clinical study consisted of 7 cases of cataract following exposure to x-rays or gamma rays, 2 cases of cyclotron-induced cataract, 10 cases of cataract attributed to the ionizing radiations of the atomic bomb in Japan, and 1 case of cataract resulting from an atomic explosion in this country. The findings were remarkably uniform in all cases. The characteristic clinical features are (1) a doughnut-shaped configuration, as seen with the ophthalmoscope, and (2) a sharply demarcated anterior boundary of opacity and a bivalve configuration of opacity, as seen with the slit-lamp biomicroscope. While these features are not seen in all stages of radiation cataract and are not found exclusively in cataract of this origin, when present they strongly suggest this type of cataract and are usually sufficient for its differentiation from posterior polar cataract and cataracta complicata, with which it may easily be confused.

The histologic changes of radiation cataract consist primarily of (1) failure of the cells at the equator to differentiate into lens fibers and (2) early migration of cells beneath the posterior capsule toward the posterior pole. These aberrant cells may cause thickening of the capsule and undergo changes that are interpreted as abortive attempts at differentiation of lens fibers. In general, the histologic manifestations of radiation cataract are less type-specific than are the clinical signs.

Nine figures.

Roentgen Hemolysis, a Contribution to the Biological Effects of Ionizing Radiation. Bruno Lindemann. Fortschr. a. d. Geb. d. Röntgenstrahlen **75**: 523–559, November 1951. (In German)

Radiation affects the membranes of erythrocytes by

changing their permeability. The older theories considered that the effect was due to bombardment, but it is now believed to be more indirect. Previously, experimental studies on living structures, such as red blood cells, was difficult, but with the advent of the electron microscope an entirely new field of research has opened up, and the erythrocytes lend themselves well to this type of experimental investigation.

As a result of electron optical structural analysis, the outer portion of the red blood cell membrane is considered to be semipermeable and composed of lipoid material. Just within is a stromal layer which acts as support. Within this is a network too fine to be observed by the usual microscope, probably protoplasmic, and within the cell the chief constituent is hemoglobin, a polymolecular component structure.

Several problems remain unanswered as to the exact minute structure of the cell, particularly the relationship of hemoglobin to the other constituents. As viewed in magnification of 1:9,000 the normal erythrocyte has a small central clear area. In the early stage of hemolysis this enlarges considerably.

Various patterns and appearances of the erythrocytes in their reaction to hemolyzing agents are discussed and illustrated. X-ray hemolysis is identical in character to that caused by osmosis, the effect being due to a primary denaturation of the membrane. *In vitro* this takes place at a minimum dosage of approximately 6,000 r. However, in the experimental work, doses of 300,000 r were used. Increase in temperature speeds the reaction.

Generally the rapidity of hemolysis is affected by three main factors: (*a*) reaction between hemolyzing agent and cell membrane; (*b*) ion penetration; and (*c*) by the formation of a diffusible mass through disintegration of the cell contents. Suspensions in blood plasma react more slowly than in other solutions. The author regards this as evidence supporting an indirect action of the x-ray. In thin suspensions of erythrocytes hemolysis is more rapid and complete than in thicker, which also confirms the fact that as the cells group together there is more or less of a protective effect. The age of the red blood cell also appears to determine, in a measure, the degree of susceptibility to radiation hemolysis.

Fifty-two illustrations.

[Although this subject is purely experimental and rather academic, the very striking and excellently reproduced photographs are worth reviewing in the original paper by anyone interested in this matter.—E.W.S.]

E. W. SPACKMAN, M.D
Fort Worth, Texas

Effects of Irradiation on Embryonic Development. I. X-Rays on the 10th Day of Gestation in the Rat. James G. Wilson and John W. Karr. Am. J. Anat. **88**: 1–33, January 1951.

On the tenth day of gestation, pregnant rats were anesthetized and the ventral abdominal wall was opened by a midline incision about 3.5 cm. in length. With a minimum of handling, one entire uterine horn was brought to the surface. Using two lead plates, one slightly larger than the other, selected implantation sites were irradiated without exposure of the mother and the remaining implantation sites. The second uterine horn was then brought to the surface and the same manipulations were performed except that no irradiation was given. This sham exposure of the second uterine horn provided non-irradiated controls. The dosage of radiation ranged from 50 to 400 r (in air). Physical factors were: 85 kv.p.; 10 ma.; 1.0 mm. aluminum added filter; half-value layer 2.0 mm. aluminum; distance 10 cm.; diameter of field 3.5 cm. The 1.0 cm. depth dose was exactly equivalent to the air dose as measured in a Presdwood phantom. After postirradiation intervals of one to five days both irradiated and non-irradiated embryos were removed, weighed, and prepared for histologic study. Four females, some of whose embryos were exposed to 50 or 100 r, were allowed to go to term. These mothers were killed on the day of expected delivery (21st day of gestation) in order that the fetuses might be identified while still in position in the uterus.

Exposure to 50 r had no appreciable effect on embryonic development. Dosage with 100 r increased slightly the incidence of intra-uterine death, and in the survivors reduced the rate of growth and caused retarded or anomalous development of the eyes in 75 per cent of embryos. The brain and urinary organs were also occasionally sites of malformations. Irradiation with 200 r caused similar but more intense effects: higher death rate, slower growth rate, and an increased number of malformations. The eyes almost invariably exhibited some defect, ranging from anophthalmia to moderate microphthalmia, and the brain and urinary organs consistently showed either retarded or anomalous development. A high percentage of defective feet was recognized after limb buds attained a sufficient degree of differentiation. Reversed asymmetry of the aortic arches and tail in a few instances suggested a tendency toward situs inversus.

Closely associated with the high rate of mortality after 200 r was a marked structural alteration in the liver of embryos receiving this dosage. In addition to other changes, hemopoietic activity in the liver was conspicuously reduced or absent after the thirteenth day, the time at which blood formation in the liver normally begins.

Exposure to 400 r always caused embryonic death within twenty-four hours.

Twenty-nine figures; 5 tables.

Relationship of Radiation Dose to Lethality Among Exercised Animals Exposed to Roentgen Rays. S. J. Kimeldorf and D. C. Jones. Am. J. Physiol. **167**: 626–632, December 1951.

The authors studied the influence of exhaustive exercise on the mortality of rats irradiated with various doses of x-rays. The radiation factors for most of the experiments were: 250 kv.p., 15 ma., 0.5 mm. Cu + 1.0 mm. Al, half-value layer 1.5 mm. Cu, target-skin distance 40 inches, 25 r/minute (air). In a few experiments the dose rate was changed to 8.5 r per minute, with 8 ma. The dose range was from 200 to 1,000 r.

In the investigation 326 non-exercised and 319 exercised irradiated male rats were used. Swimming was selected as the technic of exercise, since it represents an intensive form of muscular effort, presumably with survival as the goal.

A greater mortality, with more deaths at lower doses, resulted among the animals exercised daily after irradiation than among the non-exercised irradiated animals. For the non-exercised irradiated animals the median lethal dose was 710 r and for the exercised irradiated animals 510 r. At the median lethal dose, irradiation followed by daily exhaustive exercise was approximately 1.4 times more potent than irradiation without

exercise in the mortality produced. Exhaustive exercise in the absence of radiation was ineffective as a cause of death. Exercise prior to irradiation had no significant effect upon mortality.

Five tables; 1 chart.

The 30-Day LD-50 of Two Radiations of Different Ion Density. Joanne Weikel Hollcroft and Egon Lorenz. J. Nat. Cancer Inst. **12**: 533–544, December 1951.

With the development of accelerators for the production of roentgen and corpuscular radiation in the million and multimillion volt range, the effect of radiation quality on biologic response has become increasingly the subject of discussion and investigation. Some workers have reported the LD 50 for mice as being the same for x-rays as for 200-mev deuterons. The specific ionization density for these two beams is approximately the same. Differences might be found for radiations of great difference in specific ionizations.

Thirty-day LD 50 roentgen radiation was compared with that of the alpha particles emanating from short-lived decay products of radon injected intravenously in strain-A male mice. The integral dose of roentgen radiation necessary to produce 50 per cent death was found to be 1.42 times that of the alpha particles.

The distribution of short-lived decay particles of radon was followed for the two-hour period after injection. Distribution of the dose was calculated.

Three graphs; 4 tables. D. S. CHILDS, JR., M.D.
Rochester, Minn.

Histological Effects of Long-Continued Whole-Body Gamma-Irradiation of Mice. B. Spargo, J. R. Bloomfield, D. J. Glotzer, E. Leiter Gordon, and O. Nichols. J. Nat. Cancer Inst. **12**: 615–655, December 1951.

Long-continued exposure of laboratory animals to gamma radiation over their entire life span leads to many types of injury. The ultimate shortening of life depends on the daily dose rate. In certain strains of mice, predominant injury may consist of a lethal pancytopenia; and in other species it consists of lethal tumor induction. The authors report studies of progressive stages in the development of such changes in mice exposed daily to radiation of one of three dose rates and sacrificed at intervals of two months.

Animals were exposed to low doses of radiation at the following dose levels; 1.1 r daily, 4.4 r daily, and 8.8 r daily. After 1.1 r daily, only the ovary and thymus gland showed changes due to radiation. From six months on, primitive ova decreased more than in controls, and there was an increase in the mast cells and decrease in lymphocytes in the thymus gland after ten months. At the moderate dose level (4.4 r) changes in the ovary and thymus gland occurred earlier and were more severe, and the testis, spleen, and bone marrow were also affected. Degenerative changes in the testis were slight until ten months, increasing progressively at later intervals. The hematopoietic organs, with the exception of the lymph nodes, underwent progressive depletion, and at late intervals erythropoiesis increased in the spleen. At the high dose level (8.8 r daily), the mesenteric lymph node was also susceptible to radiation injury, beginning at ten months, in contrast to the response in the other hematopoietic organs, in which cellular depletion began much earlier.

Depletion of spermatogenesis was marked two months after irradiation, as were regressive changes in the ovary. The incidence of leukemia and of tumors was accelerated as a result of irradiation, and this increased with the rate and time of exposure. The authors state that the lowest dose used in these experiments, namely 1.1 r daily, is clearly above the tolerance level for mice if continued over a sufficiently long period of time.

Seventeen illustrations; 7 tables.

D. S. CHILDS, JR., M.D.
Rochester, Minn.

Effects on the White Mouse of a Single Whole-Body Exposure to 190 mev. Deuterons. Paul D. Rosahn, Cornelius A. Tobias, and John H. Lawrence. Am. J. Path. **28**: 37–49, January-February 1952.

White mice were exposed to a single whole-body irradiation by the deuteron beam of the 184-inch cyclotron at the University of California in doses of 3.8×10^4 ergs/gm., 7.5×10^4 ergs/gm., and 14.9×10^4 ergs/gm. (1 roentgen equivalent physical = 93 ergs/gm.)

Studies of the peripheral blood showed a prompt and significant reduction in the total white count and in the absolute number of neutrophils and lymphocytes. A slightly delayed but marked reduction in platelets also occurred. Surviving animals which received the smallest exposure showed a return of these blood elements to normal levels by the eighteenth day.

Following exposure to 190-mev deuterons, severe aplasia was noted in the bone marrow. Lymph nodes and spleen showed focal cellular necrosis, macrophage proliferation, and loss of cellular constituents.

The blood and tissue changes after whole-body exposure to the deuteron beam were proportional to the roentgen equivalent doses, and similar to the changes known to occur following other types of ionizing irradiation.

Seven photomicrographs; 6 graphs; 1 table.

Medical Problems in Radiological Defense. Frank R. Philbrook. Ann. Int. Med. **35**: 975–980, November 1951.

In the defense against atomic warfare, the medical profession must play a leading role in both planning and execution. The physical effects upon the terrain beneath an air burst can be correlated with the medical effects upon personnel by considering three major physical effects: blast (which produces mechanical trauma), thermal radiations (which produce burns), and ionizing radiations (which produce radiation sickness). The distances at which these energies are effective in producing their disaster effects vary with the "power" of the bomb and the altitude at which it is exploded.

Blast Effect: A shock wave of great pressure proceeds outward peripherally from the center, with rapid reduction in force as the distance is increased. Most damage is done by the sustained positive pressure, although some destruction may result from the negative or suction phase which follows, which is of about three seconds duration. The blast effect upon human beings may be classified as direct or indirect.

Direct injury, such as rupture of the stomach or other viscera, trauma to lungs, and rupture of eardrums may be expected as a result of compression by air blast near ground zero.

Indirect blast effects, on the other hand, may cause thousands of traumatic casualties, due to objects being blown against men or of men being blown against ob-

jects. Contusions, lacerations, and fractures are the injuries to be expected.

Thermal Effects: Infrared and ultraviolet radiations emanate from the ball of fire. These radiations burn instantly, since they travel with the speed of light. The effect may extend over a period of a few seconds. Two types of thermal injury occur: flash burns caused by radiation from the "ball of fire," and burns due to flames of combustible materials ignited by the flash.

Ionizing Radiation Effects: During the explosion of an atomic bomb, certain nuclear radiations are emitted as a result of the fissioning of the uranium or plutonium. In an air burst at 2,000 feet altitude, the clinically important ionizing radiations are the gamma rays. Unshielded individuals within about one-half mile from ground zero of a nominal air burst would receive 700 roentgens or more of whole-body radiation, which is considered the LD 100 (lethal dose for all exposed). Death ensues within about two weeks. Unshielded individuals only a few hundred feet farther away from ground zero would receive around 450 roentgens, considered to be the LD 50 dose, or the dose sufficient to kill about 50 per cent of untreated resultant cases. Proper therapy of this group could probably save many lives.

Unshielded individuals at about three-quarters of a mile from the center would receive around 250 roentgens, considered to be the median sickness dose (MSD). About one-half of these would become ill with radiation sickness. The prognosis is good, provided secondary infection is prevented or adequately treated.

Treatment of radiation sickness consists of general supportive measures, such as bed rest, nursing care, and an adequate diet, including vitamins and readily absorbable foodstuffs. Adequate fluid intake, parenteral fluids, and repeated whole blood transfusions to maintain a hemoglobin level of about 10 gm., may be lifesaving. Antibiotics, especially Aureomycin, should be used to prevent and treat intercurrent infection.

Beyond one mile from ground zero, the total body gamma radiation dosage is not clinically significant.

The great majority of casualties to be seen by the physician will be trauma and burns. Relatively few, perhaps only 15 to 20 per cent, will be due to ionizing radiation.

STEPHEN N. TAGER, M.D.
Evansville, Ind.

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